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Volume 19 February 1950 Number 2

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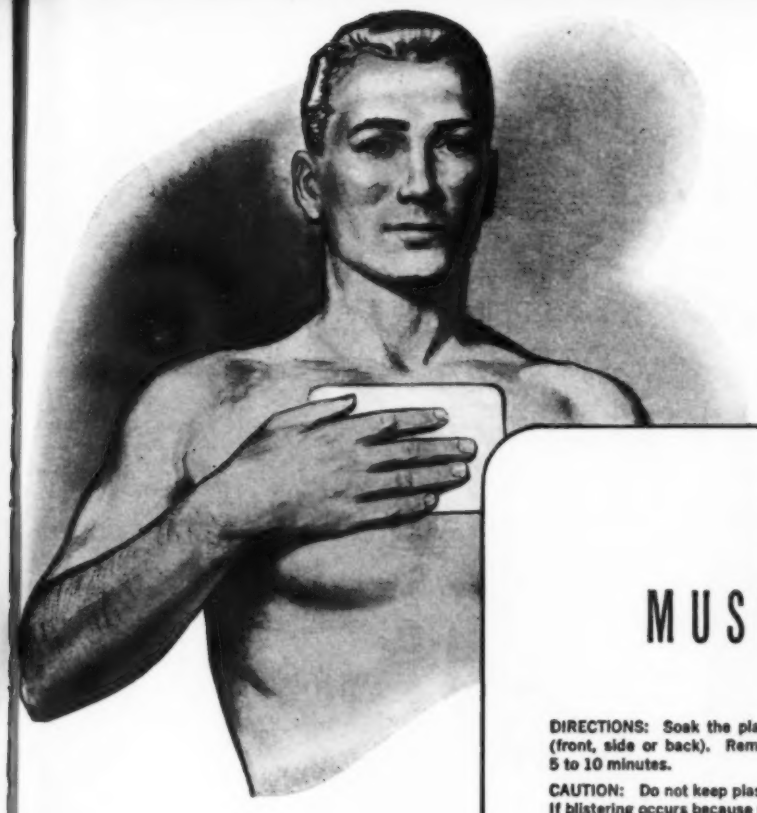

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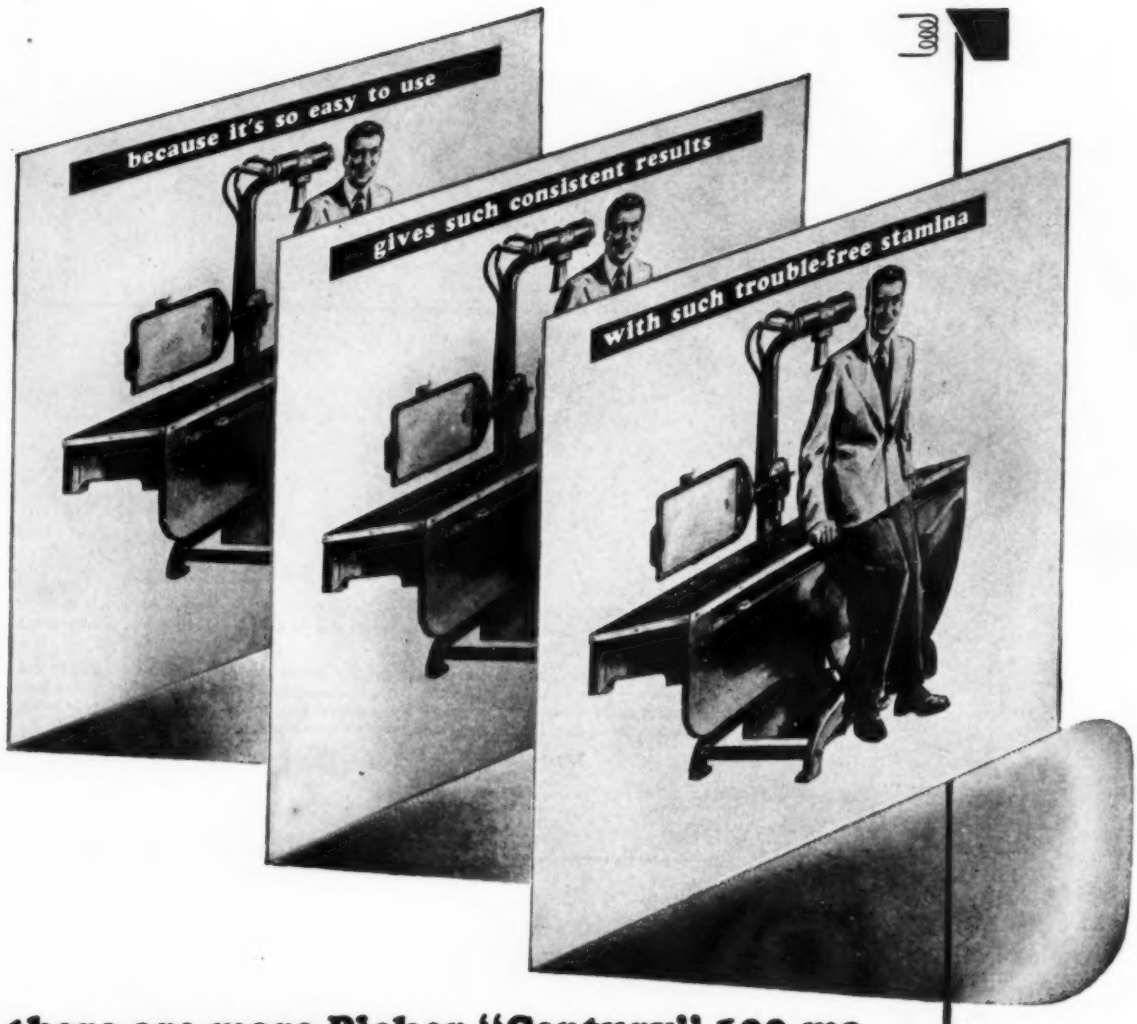

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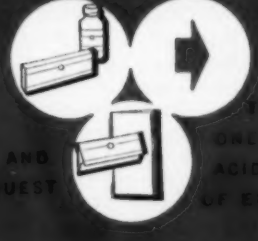

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RAYMOND HUSSEY, M.D., has been appointed Scientific Director, Council on Industrial Health, American Medical Association, and will have his headquarters at the Council offices, 535 North Dearborn St., Chicago 10. He assumed his new duties on January 15.

JOHN M. COLLINS, M.D., has resigned as Medical Director of Corning Glass Works, Corning, New York, to enter private practice at Sikeston, Missouri.

JOHN W. BROWN, M.D., has been appointed Medical Director, Corning Glass Works, Corning, New York to succeed DR. JOHN M. COLLINS. DR. BROWN is a graduate of the University of Pittsburgh and its Medical School, and interned at the university's Medical Center completing his work there in January, 1944. Commissioned a first lieutenant in the Army Medical Corps, he went overseas with the 84th Division. He was taken prisoner during the Siegfried Line offensive but succeeded in escaping and was able to return to his unit. He also served as surgeon at the Remagen Prison Camp for several months. Discharged from service in January, 1946, he was appointed to the staff of Braddock, Pennsylvania, General Hospital. The following September he became affiliated with the Bureau of Industrial Hygiene, Pennsylvania Department of Health, where he did considerable work in the field of industrial toxicology. He is a member of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, the American Conference of Governmental Industrial Hygienists, and the Pennsylvania Medical Society.

PAUL R. HAWLEY, M.D., has resigned his position as Chief Executive Officer of the Blue

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Cross and Blue Shield Commissions to become the Director of the American College of Surgeons, effective March 1. He will retain the presidency of Blue Cross' Health Service, Inc., which was chartered in Illinois in November as a national insurance company designed to offer uniform benefits to employees of large industrial and business organizations operating in the areas of several of the 90 Blue Cross Plans. As Director of the American College of Surgeons, DR. HAWLEY will succeed DR. MALCOLM T. MacEACHERN, who, as Director Emeritus, will devote his major attention to continued supervision of the program of hospital standardization.

GEORGE M. SAUNDERS, M.D., Associate Director of the Medical Department of the Monsanto Chemical Company, has been appointed Medical Director for the Overseas Operations of the Socony-Vacuum Oil Company. DR. SAUNDERS, who is Associate Professor of Preventive Medicine at Washington University, will be located in New York City.

CHARLES E. DUTCHESS, M.D., Medical Director of Schenley Laboratories, Inc., was elected president of the Association of (Pharmaceutical) Medical Directors at a luncheon meeting held at the Advertising Club of New York. DR. ROBERT HERWICK, Medical Director of the Whitehall Pharmacal Co., was named vice-president of the association and DR. KENNETH W. THOMPSON, Associate Medical Director of Roche-Organon, Inc., was elected secretary. A member of the association since 1944, DR. DUTCHESS was vice-president during the past year and also has served as program chairman in arranging a series of symposiums on the research, clinical, and product-control aspects of the pharmaceutical industry. The principal pharmaceutical firms of the nation are represented in the association. DR. DUTCHESS is active in a number of medical and pharmaceutical organizations, including the New York state and county medical societies, the Association of Military Surgeons, the Association for the Study of Internal Secretions, the American Society of Tropical Medicine, and the Pharmaceutical Advertising Club of New York. He is a fellow of the American Medical Association and the New York Academy of

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V. J. FORNEY, D.D.S., M.P.H., 4604 S. Chelsea Lane, Bethesda, Maryland.

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American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington 5, D.C.

American Association of Industrial Nurses, 654 Madison Ave., New York 21, N. Y. GLADYS L. DUNDORE, R.N., Executive Secretary.
April 23-29, 1950, Chicago.

American Association of Railway Surgeons, 5800 Stony Island Ave., Chicago 37, Illinois. CHESTER C. GUY, M.D., Secretary.

American Chemical Society, 1155 Sixteenth St., N.W., Washington 6, D.C. A. H. EMERY, Secretary.

Medicine, chairman of the Medical Section of the American Pharmaceutical Manufacturers' Association, and chairman of the Public Relations Committee of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS.

STUART F. MEEK, M.D., has entered into an industrial clinic situation, with opportunity for private practice, in Detroit. At the same time he will be able to function as a consultant to industry in the Detroit area.

PRELIMINARY Programs for the Thirty-Fifth Annual Meeting of the A.A.I.P.&S., with the four participating allied organizations, in April, at Chicago, may be obtained from DR. E. C. HOLMBLAD, Managing Director, 28 East Jackson Boulevard, Chicago 4.

IRENAEUS NICHOLSON TUCKER, M.D., Medical Director of the J. I. Case Company, Racine, for 13 years, died suddenly at the Racine Country Club on October 21. He was 57 years old. Born in Bewelcome, Mississippi, April 18, 1892, he received his degree in medicine at Tulane University School of Medicne in 1915. He interned at Charity Hospital in New Orleans and established his first practice at Tulsa, Oklahoma. During World War I he served with the Army Medical Corps. He moved to Racine in 1936 to serve as physician for the J. I. Case Company. DR. TUCKER was a member of the CENTRAL STATES SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY and the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS. He also belonged to the Racine County Medical Society, the State Medical Society, and the American Medical Association.

American College of Physicians, 4200 Pine St., Philadelphia 4, Pa. E. R. LOVELAND, Secretary.

American College of Surgeons, 40 East Erie St., Chicago 11, Ill.

American Conference of Governmental Industrial Hygienists, U. S. Public Health Service, Washington, D. C. J. J. BLOOMFIELD, Secy-Treas.
April 23-29, 1950, Chicago.

American Industrial Hygiene Association, 4400 Fifth Ave., Pittsburgh 13, Pa. HENRY F. SMYTH, JR., Executive Secy.
April 23-29, 1950, Chicago.

American Medical Association, Council on Industrial Health, 535 North Dearborn St., Chicago 10, Ill. CARL M. PETERSON, M.D., Secretary.

American Public Health Association, 1790 Broadway, New York 19, N. Y. REGINALD M. ATWATER, M.D., Executive Secretary.

Association for the Surgery of Trauma.

Canadian Public Health Association, Vancouver, B. C., Canada.

Council on Industrial Health, American Medical Association; Secretary: CARL M. PETERSON, M.D., 535 N. Dearborn St., Chicago 10.

Industrial Hygiene Foundation of America, 4400 Fifth Ave., Pittsburgh 13, Pa. JOHN F. MCMAHON, Managing Director.

International Association of Industrial Accident Boards & Commissions, MARSHALL DAWSON, U.S. Dept. of Labor, Washington, D.C., Secretary-Treasurer.

Lead Industries Association, 420 Lexington Ave., New York 17, N.Y. ROBERT L. ZIEGFELD, Secretary-Treasurer.

National Council on Rehabilitation; Secretary-Treasurer: MR. HOLLAND HUDSON, 1790 Broadway, New York 19.

National Metal Congress, Philadelphia.

National Rehabilitation Association, 411-7th Ave., Nashville 4, Tenn. LOUIS R. SCHUBERT.

National Safety Council, 20 North Wacker Drive, Chicago 6, Ill. NED H. DEARBORN, President; CARMEN FISH, Secretary.

National Tuberculosis Association, 1790 Broadway, New York 19, N. Y. H. STUART WILLIS, Secretary.

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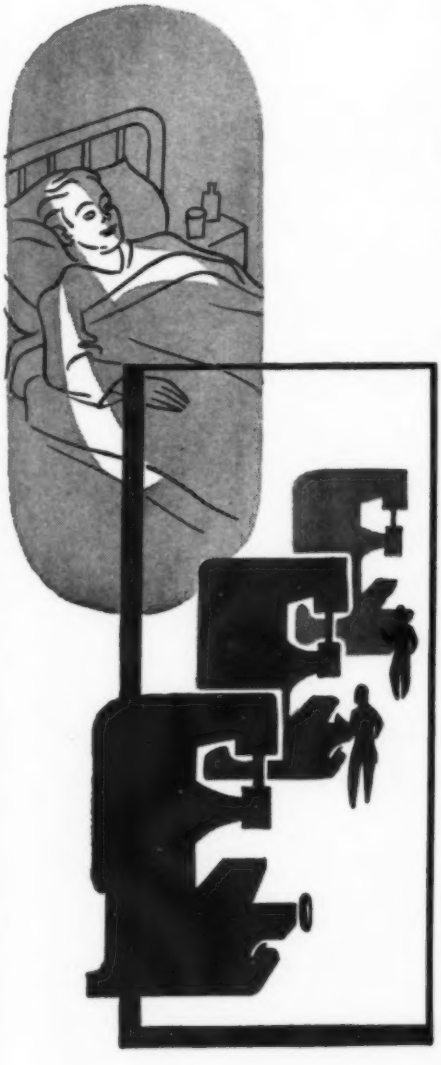

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Bibliography (1) Brewster, J. M.: U. S. Nav. Med. Bull. *47*:814, 1947. (2) Brewster, J. M.: U. S. Nav. Med. Bull. *49*:1, 1949. (3) Brewster, J. M.: Illinois M. J. *96*:302, 1949. (4) Gordon, J. S.: Laryngoscope *58*:1265, 1948. (5) Murray, H. G.: Indust. Med. *18*:215, 1949. (6) Arminio, J. J., and Sweet, C. S.: Indust. Med. *18*:509, 1949. (7) Philips, W. F., and Fishbein, W. I.: Indust. Med. *18*:526, 1949.

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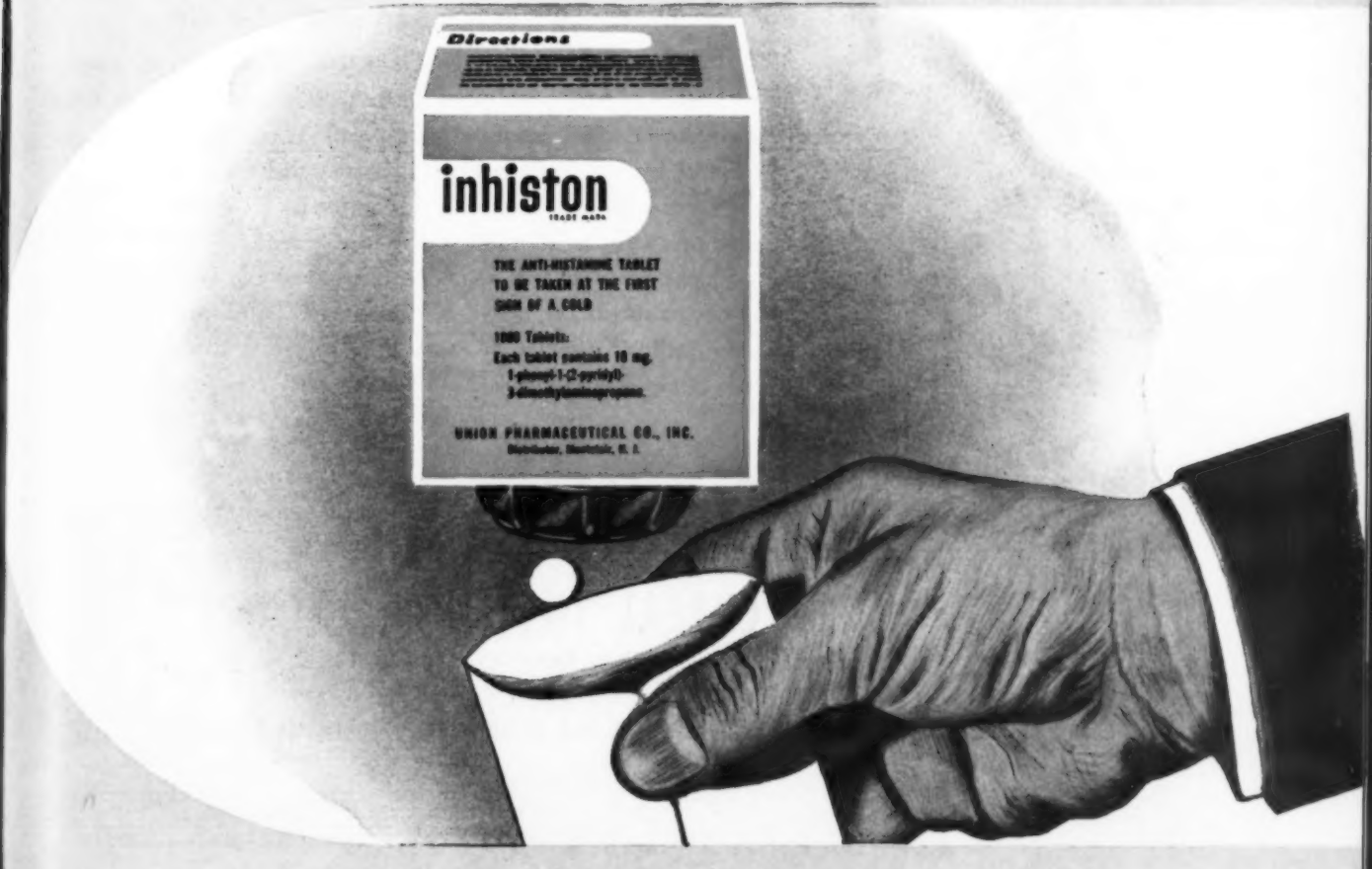

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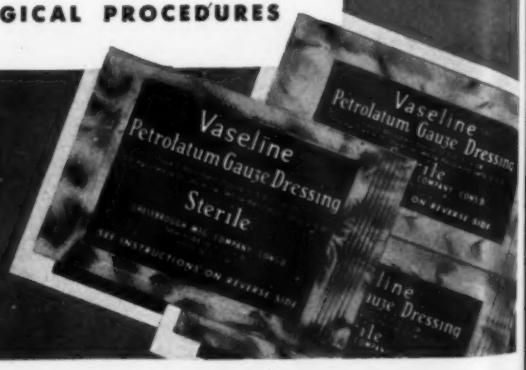

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Bibliography:

1. Alyea, E. P., and Parrish, A. A.: South. M. J. *36*:719, 1943.
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5. Kearns, W. M., in discussion on Herrold, R. D.: Wisconsin M. J. *41*:467, 1942.

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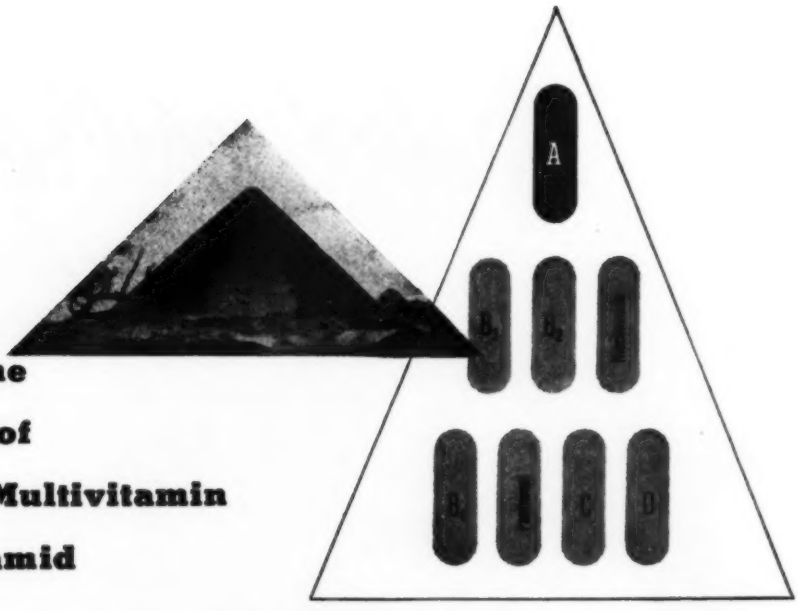

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The Toxicity of Ozone
—A Report and Bibliography—

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WEBSTER defines the word "toxicity" as "the degree of poisonousness." To state the toxicity of a substance, however, does not necessarily imply that the substance is a poison inasmuch as all substances are toxic to the human body if taken in excess of normal human tolerance. For example, ordinary table salt is beneficial in small quantities, but an excess, over a long period of time, can produce very harmful results. Arsenic, normally classed as a poison, may also be cited as another example inasmuch as it is often given in small amounts for the sake of certain beneficial reactions. The toxicity of a substance, therefore, must be described with respect to the maximum allowable "dosage" per unit time. If the human body is capable of eliminating small quantities of a substance within a comparatively short period of time, small dosages of the substance may be tolerated continually even though it may normally be considered a poison. If, however, the body has difficulty in eliminating the substance, toxic effects may result from long exposure to what is normally considered a non-toxic concentration. Ozone falls in the former class of compounds, whereas carbon monoxide may be classed as an example of the latter type substance.

Gases may also be classed as irritant or non-irritant gases. Irritant gases are so called because their first reaction is generally on the skin, mucous membrane or tissues of the nose and throat, whereas non-irritant gas usually requires absorption in the lungs before toxic results appear. In general, it may be stated that the non-irritant gases are the most dangerous because the toxic limit may be exceeded before a physical result on the human body is noticeable. Boron trichloride, chlorine, dimethyl ether, ethylamine, ethylene oxide, and ozone may be given as examples of various degrees of irritant gases; and carbon monoxide and methyl chloride as examples of non-irritant gases.

A study of the ozone literature will show that the majority of the investigators of the toxicity of ozone which was used in air conditioning systems consider ozone either detrimental or definitely poisonous in concentrations above 1.0 part per million by weight. In contrast, however, the majority of the investigators using ozone for medical purposes are of the opinion that ozone is generally less toxic. A study of the original papers reveals the interesting fact that as a rule the investigators reporting low toxic limits for ozone used air in their ozonizers, and also used ozonizers employing comparatively high current densities. The investigators reporting no, or very high, toxic limits for ozone generally were using cylinder oxygen in their ozonizer or were using air and employing low current densities. Ozonizers used for air conditioning purposes invariably, for economic reasons, use air as a source of oxygen to produce ozone, whereas medical investigators seem to prefer the use of cylinder oxygen in their ozonizers probably because they feel that an excess of nitrogen from the air would confuse their results. High voltages and the resulting high current densities are frequently employed in air conditioning ozonizers, because in that manner more ozone can be obtained from a smaller installation. If the ozone odor from an air ozonizer operating at a low current density is compared with the ozone odor from the same ozonizer operating at a high density, a distinct difference can be detected. The ozone at high current density will produce a much higher concentration of ozone and, of course, will require dilution before direct comparison is made. At equal low concentrations the ozone obtained from the high current density operation will have a very "acid" or "chlorine" odor, whereas at low current density operation the ozone will lose its "acid" odor and smell entirely different. A chemical analysis of the output of an ozonizer operating at low and high current densities will show a direct relation between the current density and the output of nitrogen oxides, i.e., more nitrogen oxides will be produced at a high current density than at a lower density. If pure oxygen is used in an ozonizer, no difference in odor can be detected between low and high current density operations. This fact indicates that oxides of nitrogen are the chief cause for difference in odor of gaseous ozone.

Probably the most unique property of gaseous ozone is its peculiar odor, which is detectable by the trained human nose in concentrations of less than one-tenth part per million by weight. The qualifying word "trained" has been used because ozone may be easily confused with other odorous gases; in fact, most people cannot differ-

entiate between odors of nitrogen oxides and ozone unless each of the gases has been isolated and physically demonstrated individually. Such a demonstration is best carried out if each gas is at a very dilute concentration, because the characteristic odor of an odorous compound is often obscured at high concentration. This is evident to anyone who has tried to identify the odor of a concentrated perfume directly from the liquid.

Because everyone interprets odors differently, and in each case a personal comparison is used in classification, it is somewhat difficult to describe the odor of ozone to everyone's satisfaction. Using test cabinets and subjecting a large number of people to various concentrations of ozone and oxides of nitrogen, the following average consensus was obtained:

Pure ozone, (no nitrogen oxides) could be detected at 0.1 part per million, and up to 2.0 parts per million had an odor of clover or "new-mown" hay. From 2.0 to 10.0 parts per million, the odor was reported by the majority as similar to the odor of garlic. Above 10 parts per million, the odor became more acid in character but could be differentiated from nitrogen oxides. Mixing extremely small amounts of nitrogen oxides with ozone completely changed the above clear-cut characterizations. For concentrations of 0.1 to 5.0 parts per million, opinions varied from that of chlorine to that of ammonia. Above 5.0 parts per million, the odor was generally reported as acid in character and very obnoxious. This is in direct contrast to pure ozone which was generally not reported as obnoxious until a concentration of at least 20.0 p.p.m. was reached.

The above results indicate that all work dealing with the toxicity of ozone must be carefully evaluated with respect to the purity or nitrogen oxides content of the ozone used. Abstracts dealing with the toxicity of ozone do not generally go into any detail as to the type of ozonizer used or give details as to the quantity of nitrogen oxides present in the ozone. For this reason, in properly evaluating the literature on the toxicity of ozone, it has been necessary in most cases to obtain and evaluate the original paper. Work which recognized or eliminated the influence of nitrogen oxides has been classed as "reliable," whereas work which ignored the influence of nitrogen oxides has been considered "unreliable." A study of the ozone literature reveals that the reports listing ozone as a highly toxic substance are of rather early vintage, i.e., before 1939.

Although it was originally intended that only reliable literature would be cited in reference to ozone toxicity, it was soon realized that only two or three references could be so considered. In order to show the great variance of opinion between investigators of the toxicity of ozone, many of the so-called "unreliable" references found dealing directly with the toxicity of ozone to the human body are cited. Many references were also found dealing with the toxicity of ozone to various bacteria and lower forms of life. The action of ozone in various diseases and injuries of the human body is also extensively described in the literature. Several examples of the last two subject categories are given in the bibliography as a matter of interest.

Von Kupffer[87] and Czaplewski[26] called attention to the harmful effects of nitrogen oxides in ozone as early as 1913. In spite of these and several other references, no direct study of the influence of nitrogen oxides on the toxicity of ozone was published until 1941. At that time, Thorp[83] published a paper pointing out the possible cause of discrepancy between investigators of the toxicity of ozone. The data in his report showed how the source of ozone would influence the toxicity of ozone. One of the points brought out in Thorp's paper was that, although ozone free of nitrogen oxides was non-toxic in concentrations of 20 parts per million, and the toxic limit for nitrogen oxides alone was 20 parts per million, the toxic limit for ozone containing nitrogen oxides was more toxic than nitrogen oxides alone. Fredrick[37] suggested that a new compound which he called "nitrogen ozide" which could be very irritating and toxic might be formed by the reaction of ozone with one of the nitrogen oxides. He based this supposition on the fact that when ozone is mixed with NO_2, it rapidly disappears, indicating probable chemical reaction. Although it has not yet been definitely shown why ozone containing nitrogen oxides is highly toxic, it has been definitely established that ozone free of nitrogen oxides is comparatively non-toxic. Confirmation was made in 1942 by Hill, a physician specializing in industrial hygiene. In 1921, Hill and Aeberly[44] published a series of articles reporting on tests concerning the effects of ozone, chemically, physically, and physiologically. As a result of these tests a toxic limit for ozone was established at 1.0 part per million. It was also stated that 20 parts per million with an exposure of two hours might prove fatal to human beings. After noting the work of Thorp previously mentioned, Hill, realizing that oxides of nitrogen had been present in his previous test, decided to rerun the test on an identical basis to determine if pure ozone had higher toxic limits. These later tests showed that pure ozone was definitely non-toxic in concentrations as high as 50 parts per million. As a final result of his work Hill[43] states "pure ozone is not poisonous in any sense of the word as it breaks down in contact with the mucous membrane and oxygen only remains. For this reason there are no cumulative effects and pure ozone may be breathed for long periods of time without harm provided, of course, that the immediate irritation of strong concentrations is avoided."

Ozone Concentration Conversion Factors

OZONE concentrations are reported in the literature in many types of units. The most common units used are parts per million by volume, parts per million by weight, milligrams per liter, and per cent. This is extremely confusing because it does not allow direct comparison of

concentrations used by different investigators without converting to some standard type of units. At Armour Research Foundation, two types of units have been made standard. These are: parts per million by weight, and weight per cent. Parts per million by weight are used to represent very low concentrations below 1.0%, and weight per cent is used to represent all concentrations above that concentration. Concentration units in terms of weight were decided upon after a careful consideration of the advantages involved. Chemical analysis of ozone is usually done by the potassium iodide method which gives directly the quantity of ozone in grams. The use of weight concentration units also eliminates the necessity for reporting temperature and pressure.

Although some effort is being made to standardize the reporting of ozone concentrations in terms of parts per million by weight, the majority of the investigators have reported their results in terms of parts per million by volume. Abstracts usually neglect to report whether the concentration pertains to ozone in oxygen, or ozone in air and also sometimes neglect to report whether weight or volume concentrations are used. Such abstracts, of course, cannot be compared with each other with respect to ozone concentrations, and the original papers must be obtained for comparison purposes. Even then, it is frequently found that the author reporting weight per volume concentrations has completely neglected to specify the temperature and pressure, under which he made his measurements.

In this paper all concentrations are reported by parts per million by weight or weight per cent in air. In many cases, in converting concentrations given in the bibliography to weight concentration units, some inaccuracies were introduced because the authors neglected to state temperature and pressure conditions and whether the ozone was contained in oxygen or air. Table 1 provides a table of ozone concentration conversion factors which may be used to compare other references not contained in the bibliography.

Discussion of Bibliography

ALTHOUGH a few references contained in the bibliography have already been mentioned in this report, it is advisable at this time to discuss some of the other references on which original papers were obtained.

Toxic concentrations of various gases were detected[32] in a number of Massachusetts industries. Up to 300 determinations were made for various types of poisonous substances, but only one is given for ozone. The maximum allowable concentration for ozone is given as 1.7 pts/million by weight.

This toxic limit for ozone was obtained by reference to previous work involving the use of ozone containing oxides of nitrogen. The low toxic limit specified in this publication, therefore, is not considered reliable.

Aubourg[7] reports that ozone, by its oxidizing energy, is bactericidal and non-toxic. He claims it is a healing agent of value, as it has no corrosive action on tissues, and, that when given internally, it leaves an excess of oxygen in the blood. It was used locally on wounds, fistulas and post-traumatic suppurations. Of 150 surgical cases thus treated, 80% healed, 10% improved, and 10% were failures.

The work of Aubourg is interesting from the standpoint that he used ozone made from oxygen and found that the ozone had no corrosive action on tissues. Although Aubourg used concentrations of ozone generally considered irritating to tissues, the rapid decomposition of ozone to oxygen probably reduced its concentration to an acceptable level.

The fact that ozone in small quantities can be safely injected into muscles and into the blood stream is demonstrated by the papers of Barker,[10] Chamorro,[19] Kleinmann,[51] Yamamoto,[97] and Zorraquin.[98] The results of these workers

TABLE 1.
OZONE CONCENTRATION FACTORS

0° C — 760 mm.
1 liter of ozone weighs 2.144 g.
1 liter of oxygen weighs 1.429 g.
1 liter of air weighs 1.293 g.

To convert:

Parts per million to per cent, divide by 10,000 (A)

Parts per million by volume to parts per million by weight:
- in oxygen, multiply by 1.50 (B)
- in air, multiply by 1.66 (C)

NOTE: If over 10,000 parts per million for accuracy convert first to per cent and then use equations (H) or (I).

Milligrams per liter to parts per million by weight:
- in oxygen, multiply by 700 (D)
- in air, multiply by 773 (E)

NOTE: If over 10.mg/1. for accuracy convert directly to per cent by means of equations (F) or (G).

Grams per liter (X) to weight per cent, use the following equations:

in oxygen, (F)

$$\text{Wt. \%} = \frac{(X)\ (100)}{1.429 + (.334)\ (X)}$$

in air, (G)

$$\text{Wt. \%} = \frac{(X)\ (100)}{1.293 + (.397)\ (X)}$$

Volume per cent (Y) to weight per cent, use the following equations:

in oxygen, (H)

$$\text{Wt. \%} = \frac{(Y)\ (214.4)}{142.9 + (.715)\ (Y)}$$

in air, (I)

$$\text{Wt. \%} = \frac{(Y)\ (214.4)}{129.3 + (.851)\ (Y)}$$

using pure ozone may be compared with that of Tsurumaki[86] who used high concentration ozone containing oxides of nitrogen. Tsurumaki reports that when air containing 1500 to 23,000 pts/million by weight of ozone is applied to an isolated frog heart through Ringer solution, held in a cardiac cannula at a rate of 40 cc. per min. dilation and contraction diminish. The amplitude is greatly reduced and cardiac frequency is generally increased. Ozone probably has a stimulative action on the heart muscle, but sometimes after its administration irregularity and slowing of the heart beat are to be observed. If ozone application is discontinued after marked dilation, the heart never returns to its normal state again. When ozone is applied outside of the heart, changes in heart action are but slight. Tonicity of the cardiac muscles falls gradually, with decrease of both amplitude and frequency.

The work of Bass[11] demonstrates that 1.7 parts per million by weight of ozone is not unpleasant and may be considered non-toxic. The ozonizer used for his work probably produced very small amounts of oxides of nitrogen, inasmuch as a very low humidity was maintained, and sparking between the electrodes was not encountered.

The poor insecticidal power of ozone is demonstrated by the work reported by Toul.[85] It is stated that larvae (meal worms) were immediately killed by 2.5% ozone; 1% ozone killed in 12 hours, 0.5% in four days, 0.1% in seven days, 0.096% killed 75% of the larvae in 15 days, 0.08% did not kill in 14 days but had a deleterious effect, and 0.05% had no effect.

Manufacturers of ozone equipment have often claimed that ozone is useful in the elimination of carbon monoxide encountered in garages, buses, planes, etc. It is generally recognized, however, that the reaction rate of low concentrations of ozone with carbon monoxide is extremely slow. The high concentration of ozone needed to accomplish an appreciable reaction would not only be fatal to human beings, but would also be unobtainable from any ordinary commercial ozonizer using air. The papers of Clausmann[21] and Salls[78] confirmed these facts over 20 years ago.

For a number of years, there have been various small ozonizers sold for use in the home and in small rooms. As a general rule these small ozonizers utilize several small pieces of ordinary window glass or mica as a dielectric superimposed between wire screens or perforated metal plates. Such crude and unscientific construction results in the formation of sparks and abnormal heat. Tests on such units show that the output of nitrogen oxides is equal to and, in many cases, greater than the output of ozone. The majority of the reports claiming ozone to be a highly toxic gas are a direct result of the use of such equipment in making toxicity studies. The reports of the American Medical Association,[1] Dadlez,[27] Elford,[31] and Konrich[52] may be cited as examples.

Huntington,[45,46] over a period of many years, has made a study of the normal ozone concentration encountered at various locations on the earth. He has statistically analyzed the variation of atmospheric ozone concentrations with respect to various physiological characteristics of mankind. His analysis indicates that both the short and long periods of high mental activity and high reproduction rates occur during the periods of highest ozone concentrations. Although his work is quite extensive and shows correlation between ozone concentration and practically every physiological characteristic encountered, it is still only a statistical analysis, and therefore subject to considerable debate. An interesting fact brought out in Huntington's studies is that in certain sections of the world the normal ozone concentration very frequently exceeds one part per million by weight. It is not generally realized that ozone exists in varying amount over the face of the earth, and even in large cities an appreciable amount of ozone is usually present. Statements in the literature to the effect that ozone is not present in large industrial cities are erroneous. An analysis of the ozone concentrations existing in Chicago, Illinois, over a period of a year showed that the minimum concentration existing was .01 parts per million by weight and the maximum concentration frequently found was .15 parts per million by weight. As a matter of interest, the concentration of ozone found at Murray Hill, New Jersey, over a period of one year by Crabtree[24] is reproduced as Fig. 1.

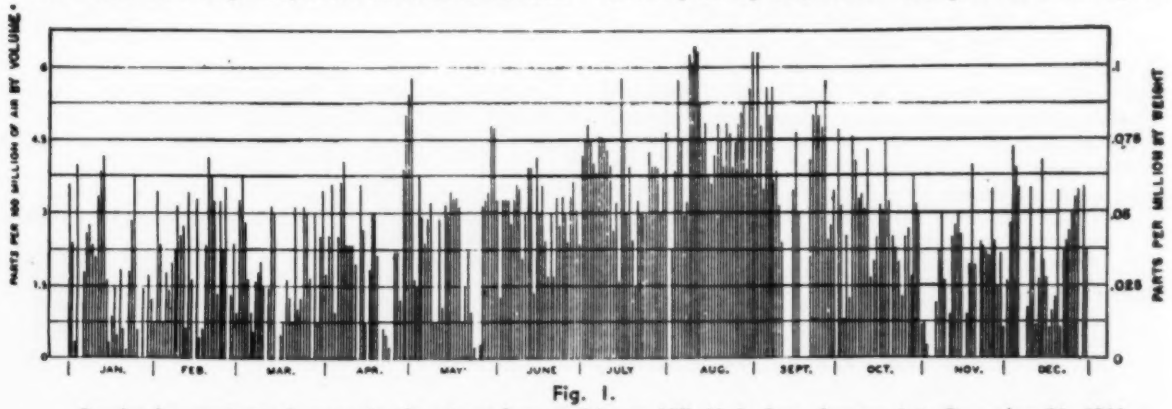

Fig. 1.

Day-by-day content of ozone in the atmosphere at Murray Hill, N. J., from January 1 to December 31, 1944. Reproduced from Crabtree and Kemp

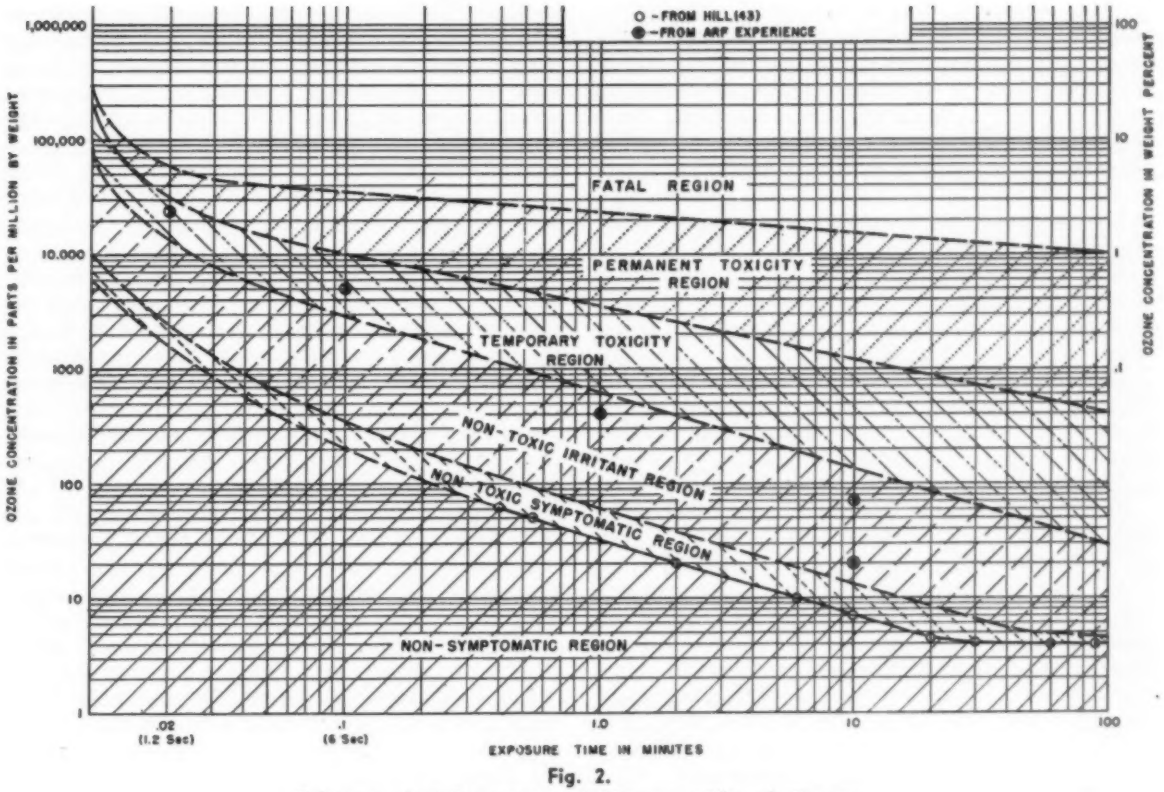

Fig. 2.

Tolerance chart for ozone containing no oxides of nitrogen

Effect of Gaseous Ozone on Human Beings

THE literature shows quite conclusively that ozone containing nitrogen oxides is toxic and exposure to concentrations of over 1.5 parts per million by weight for long periods of time may be considered definitely detrimental to humans. Ozone made from oxygen may be considered essentially free of nitrogen oxides. This section will deal only with the toxic limits of such "pure" ozone.

In Fig. 2 is shown what is considered the toxic limits for pure ozone. This graph is based in part on the work of Hill,[43] Thorp[83] and actual experimental experience at Armour Research Foundation. The graph has been conservatively constructed to insure that, although it may be found that the toxic limits of ozone are much higher, the graph can be used to safely predict the effects of ozone on workers exposed to various concentrations. The solid line outlining the "non-symptomatic region" was taken directly from Hill. To date there has never been a fatality reported from high concentration gaseous ozone. This is due to the fact that high concentration ozone has not yet been made available in large quantities. As the use of liquid ozone increases, and as the quantity of such concentrated ozone is increased, there will be a correspondingly increasing danger of such fatalities occurring.

It should again be emphasized that ozone is a highly odorous compound. One part per million by weight may be easily detected by anyone. Up to four parts per million may be classed as the "non-symptomatic region," i.e., a worker exposed to concentrations in this range experiences no physical effects except odor. There are, however, several definite physiological effects which occur in direct proportion to the concentration. The lungs can apparently absorb oxygen at a higher rate from air containing ozone than from air alone and, therefore, a decrease in the basal metabolic rate will be experienced. A decrease in metabolism of from 10 to 20% will occur with an exposure of five hours to two parts per million by weight of ozone. The pulse rate will also be lowered by an average of approximately 5%.[43] There will also be a marked decrease in blood pressure in people having initially high blood pressure. According to Dadlez[27] the depression of blood pressure by ozone is a consequence of the dilation of the peripheral blood vessels. Strangely enough, ozone does not appreciably lower the blood pressure of young people or those having normally low blood pressures.

Immediately above the non-symptomatic region, there is a narrow region which may be called the "symptomatic non-toxic region" because in this region the first physical effects of higher concentrations of ozone occur. Although even in concentrations as high as 50 parts per million applied for short periods of time there is no irritating physical effect, there is a characteristic symptom which is always present above concentrations of four parts per million. This symptom has been termed "sub-sternal pressure." The following from Hill[43] adequately describes it:

"This symptom which we have referred to as sub-sternal pressure was noted by practically every subject who entered the cabinet and stayed a sufficient length of time to make physiological observations. A pressure, or discomfort, or a feeling of weight as some described it, developed beneath the lower part of the sternum, possibly at the bifurcation of the trachea. Several subjects described this symptom as similar to that experienced after running a considerable distance and becoming out of breath. It is constantly present in practically all subjects and bears a relationship to the concentration of ozone being breathed at the time of exposure."

This region may be considered non-toxic because no irritation of the mucous membranes occurs and the primary symptom of sub-sternal pressure disappears immediately after the ozone concentration is reduced to four parts per million.

In the next higher concentration region, the first primary irritant symptoms appear. These are evidenced by coughing, smarting sensation in the nose and throat, and, in some cases, smarting and watering of the eyes. The smoking of tobacco greatly increases the symptoms, but ordinarily the symptoms are mild and do not cause much distress. Upon removal from this region of concentration, the symptoms rapidly disappear within an hour. Owing to the primary irritation and sensitization of the mucous membranes, however, less resistance to colds, tonsilitis, etc., is experienced for several days after such exposure. This region of first primary irritant effects may be termed the "non-toxic irritant region." The region may be classed as non-toxic and generally not harmful, but workers should not be exposed to this region of concentration except in cases of emergency or in cases where experimentation makes such exposure definitely necessary. The worker exposed to such concentrations should not attempt to smoke for hours after such exposure and should also realize that the mucous membranes of the nose and throat have been irritated and are thus more liable to infection for at least two days after exposure. Generally, the ozone odor in this region is so intense that it is obnoxious enough to make anyone remove himself from the concentration as soon as possible.

The next higher concentration region may be termed the "temporary toxic region." This region is similar in effect to the irritant region, but the effects are much more severe and prolonged. Acute inflammation of the mucous membranes of the nose and throat occurs and is of such severity that several days may be required for recovery. Several additional symptoms manifest themselves in this region. These are throbbing headaches, and partial paralysis of the respiratory organs. In this region paralysis is not usually complete and the subject is able to force enough air or oxygen into his lungs without need of artificial respiration. The paralysis effect usually disappears within at least an hour after exposure. Physical effort should be avoided after exposure to ozone concentrations in this region, and immediate rest is advisable. The extreme pain of the inflamed mucous membranes in the nose and throat may be soothed by the use of ordinary nose drops containing aromatic oils. Inhalation of the vapors of such oils is also beneficial. The upper limit of this range, as shown in Fig. 2, has been drawn as an hypothesis from actual experiences of members of the Foundation staff who have been accidentally exposed to such concentration.

The limits of the "permanent toxicity region" and the "fatal region" can only be estimated because no actual data have been accumulated with respect to such concentrations. Their position in Fig. 2 has been estimated from experiences encountered by the staff in the temporary toxic range, and also from the effects of such concentrations on mice and other animals. It is expected that the symptoms encountered by exposure in the permanent toxic range would not only be similar to the effects noted for lower concentrations, but would also be very much similar to the effects encountered with other gaseous oxides. For this reason the following principles, specific action medication, and laboratory tests usually specified for gaseous oxides,[61] should be employed in cases of exposure to ozone concentrations in the permanent toxic range. The following direct quotation from the Manufacturing Chemists Association Chemical Safety Data Sheet for nitric acid may be of value:

GENERAL PRINCIPLES: "The main treatment objective is to maintain an adequate supply of oxygen to the tissues. To do this, the congestion of the lungs (pulmonary edema) which follows after five to eight hours or more must be prevented. If possible, oxygen must be supplied as soon as possible in amounts adequate to maintain the normal color of the skin and mucous membranes. The method recommended for oxygen administration is described in the following section. A physician should be called immediately, the type of exposure and the exact location of the patient being explained to him."

SPECIFIC ACTIONS: *Proper Oxygenation and Bed Rest.* "As soon as there is any indication of poisoning from gaseous oxides, carry the patient (do not allow him to walk) to an uncontaminated atmosphere, disperse any crowd, and facilitate breathing by loosening the clothing around the neck and chest. Artificial respiration should not be given unless breathing has ceased. It is at this time, i.e., in the 'quiescent' asymptomatic period immediately after inhalation of the gaseous oxides, and at an aid station in the vicinity of the place of exposure, if possible, that the inhalation of 100% oxygen, preferably exhaled against positive pressure of not more than 6 cm. (about 2⅜ inches) of water, should be started to prevent the development of pulmonary edema. This may be effected readily by connecting by tubing the outlet valve of a snugly fitting face mask to a water bottle, inserting the end of the tube to a distance of not more than 6 cm. below the surface of the water. The

water pressure resisting exhalation should be adjusted to the patient's tolerance by varying the depth of the end of the tube below the water's surface. The patient should breathe the 100% oxygen for 30 minutes out of every hour for six hours. If breathing appears normal, and if there are no signs of pulmonary edema and the patient is comfortable at the end of this time, oxygen inhalation may be discontinued. Bed rest should be enforced for at least 24 hours, during which time the patient should be under the observation of a physician or other experienced personnel to insure resumption of oxygen inhalation should respiratory symptoms appear. If the patient remains free of symptoms, he may be permitted to return to work after 24 hours. Under no circumstances should an employee return to work before he has been examined by the plant physician or other physician who is familiar with the hazards involved, and has been found free of residual signs of injury. Those cases which develop pulmonary edema, signs and symptoms of other injuries, or intercurrent infection should be treated by the physician according to accepted principles of therapy appropriate to the patient's condition."

Medication. "Since the excitement and apprehension which accompany inhalation of gaseous oxides are due in great part to lack of oxygen, those symptoms usually disappear when adequate oxygen is supplied in the manner already described. Mild analgesics and sedatives, such as acetylsalicylic acid or sodium bromide, may be given if thought by the physician to be desirable, but medication is usually unnecessary when adequate oxygen (preferably exhaled against a positive pressure of 6 cm. of water) has been administered immediately after exposure. Since morphine depresses the respiratory center, its use in gaseous oxide poisoning merely handicaps further an already embarrassed respiratory system. *Therefore, morphine should not be used.* Because of their depressant effect on respiration, barbiturates should never be given in cases of poisoning with gaseous oxides, and sulfonamides should not be given initially because of the possibility of adverse effects on the hemoglobin, i.e., methemoglobin formation, with resultant increase in the oxygen deficiency of the tissues. If required for the control of secondary infection, these drugs may be used later at the discretion of the physician in the absence of signs of circulatory collapse and anoxia. Cardiac and respiratory stimulants will be found unnecessary when the underlying oxygen deficiency has been corrected and are not recommended. In certain relatively rare cases in which the patient has responded to the irritation of the gases with laryngospasm or bronchospasm, so that the respiratory passageway is obstructed, the medication of greatest value is nebulized adrenalin solution (1:100). This is inhaled until the functional spasm has been relieved and respiration is unobstructed."

Laboratory Tests. "The physician will find the following tests useful in appraising the patient's clinical course:

(a) periodic spirograms to indicate changes in the vital capacity;

(b) periodic chest x-rays, not only to determine the amount of pulmonary edema, but also to aid in the early detection of any intercurrent pulmonary infection;

(c) oxygen saturation of arterial and venous blood;

(d) methemoglobin determinations."

It can be seen from the foregoing discussion that ozone is essentially non-toxic up to a concentration of 1000 parts per million by weight for short periods and 20 parts per million for long periods of exposure. The irritant region of concentration should be avoided but, owing to the non-toxic and non-permanent nature of the symptoms involved, no special safety precautions are necessary. A worker, however, should never be knowingly exposed to concentrations greater than the irritant region without adequate safety precautions being taken. A gas mask employing a powdered manganese dioxide cartridge may be used in the temporary and permanent toxicity regions. Such a gas mask should be constructed of plastic materials which are known not to react with gaseous ozone. Natural rubber or leather should never be used. Foundation test results have shown that powdered manganese dioxids will decompose ozone in concentrations below 8% into oxygen. Ozone concentrations above 25% are explosive and it is doubtful whether a gas mask can be used satisfactorily in concentrations of 25% or higher. Until further knowledge is gained in this respect, precaution should be taken in advance to preclude the possibility of any worker being exposed even momentarily to concentrations of 25% and higher.

Effect of Liquid Ozone on Human Beings

THE same safety precautions used for liquid oxygen should be used in the handling of liquid ozone in concentrations of 10 weight per cent or less. The reaction of such dilute concentrations on the human skin is similar to that of oxygen in that the rapid extraction of heat from the skin will result in severe burns. Asbestos or heavy cloth gloves may be used where there is danger of splashing such dilute mixtures. Rubber or leather gloves should never be used. It should also be pointed out that if a very large amount of dilute ozone is spilled on a warmer surface, the oxygen will rapidly evaporate leaving concentrated ozone which is highly explosive in the presence of even a trace of organic material.

Liquid ozone in concentrations of 10 to 30 weight per cent should be handled with the same care necessary with 90% hydrogen peroxide. In addition to the severe burns which will be encountered by splashing of the liquid on the skin, there will also probably be considerable bleaching and oxidation of the skin tissue.

Concentrations of liquid ozone in excess of 30% by weight will explode with extreme violence

if brought in contact with extremely minute quantities of reactable organic matter. In the pouring and handling of such liquids extreme care should be taken to see that all parts of the apparatus or containers in which the ozone is to be placed or is to be transferred to are scrupulously clean with respect to reactable material. Concentrations of liquid ozone of 70% or higher are extremely dangerous and require special technics for handling.

The vapor pressure of liquid ozone at liquid oxygen temperatures, (−183°C) is less than one millimeter. For this reason the concentration of ozone gas given off by solutions of ozone at that temperature is very low and in fact is below the toxic limits for ozone. If adequate ventilation is provided in the room containing the liquid ozone maintained at liquid oxygen temperature, no safety precaution is needed with respect to the gaseous ozone concentration issuing from the ozone container. However, in an unventilated or poorly ventilated room there is danger of the concentration of gaseous ozone building up to the temporary toxic region. In such a case it is advisable to provide a small absorption tube containing powdered manganese dioxide at the top of the liquid ozone container so as to insure that all the ozone is decomposed before issuing into the room. Concentrated liquid ozone at temperatures greater than the boiling point of liquid oxygen will give off much higher concentrations of ozone depending, of course, on the concentration of ozone and the temperature maintained. It is not advisable to protect such containers with a powdered manganese dioxide absorption tube because the gaseous ozone concentrations may be above the explosive limits, namely, 30 weight per cent. It is, therefore, advisable to provide adequate ventilation wherever liquid ozone is used at temperatures higher than −183°C.

Summary

THIS paper presents data on ozone toxicity based on experiments and experience of Armour Research Foundation staff members, supplemented by a critical evaluation of the published work of other investigators. It is shown that much of the early work on this subject was with ozone in air inadvertently contaminated with nitrogen oxides. Inasmuch as the toxic limits of mixtures of these two substances in air are distinctly lower (1.0 part per million) than for either pure nitrogen oxides (20 parts per million by weight) or pure ozone alone (20 parts per million by weight), it is easily understood why ozone was considered by many to be a highly toxic substance. Later workers, taking cognizance of the synergistic effect of nitrogen oxides, found ozone tolerance by humans to be far higher than previously suspected, even as high as 50 parts per million.

A graph is presented showing ozone concentrations and duration of exposure required to produce various physiological effects classified as: non-symptomatic, non-toxic symptomatic, non-toxic irritant, temporary toxicity, permanent toxicity, and fatal. The limits of the permanent toxicity and fatal zones are only estimates, inasmuch as the study of physiological effects with these very high concentrations (1 to 30 weight per cent) has not been undertaken. The absence of reported fatalities is attributed to the fact that heretofore concentrations of potentially lethal order have not been encountered on any appreciable scale. It is evident that lower concentrations of pure ozone of the order of 50 parts per million have no cumulative effect. Treatment based on that recommended for other gaseous oxides is described for ministering to subjects exposed in the permanent toxic range.

Precautions in handling liquid ozone of various concentrations in liquid oxygen are outlined, and means for preventing the accumulation of high gas concentrations during evaporation of liquid are described.

A bibliography of 98 references is included.

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The Use of Wire Suture in Inguinal Hernia Repair

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MANY factors enter into the successful repair of inguinal herniae. Of great importance is the correct evaluation of the pathology present and the selection of a method of repair that will correct it. Defects are sometimes multiple, and, in the writer's opinion, some of the recurrences following indirect hernia repair are due to overlooked co-existing direct defects. The fact that most recurrences are direct herniae is evidence to support this view. It is obvious that the use of any particular suture material will not prevent all recurrences, and that the choice of suture material is but one phase of the problem. Regardless of the type of defect or the method used for its repair a prime requisite for uniform success is rapid, uncomplicated wound healing. This can be attained better by using non-absorbable sutures because catgut by its inherent nature causes inflamatory reaction by which it is absorbed. This delays healing and favors infection.

Of the non-absorbable sutures available, stainless steel wire has the outstanding attribute that it does not slough out or cause a persistent draining sinus as does cotton or silk if infection should occur. This may in large part be due to the fact that wire consists of a single filament that lacks interstices between strands in which bacteria can lodge to form a nidus of infection which the body defenses cannot successfully attack.

The advantages of stainless steel wire are now well established since Babcock first introduced it in 1934,[1,3,7,9,10] and it is anticipated that it will be used more extensively in the future. The purpose of this paper is to discuss the technique of using wire in the hope that it will offer something of value to those who have not used it or have had only limited experience with it.

When the surgeon uses wire for the first time he is impressed with the fact that it differs in its physical properties from all other suture materials with which he is familiar and cannot be handled in the same way. Catgut is commonly used in long strands and ties are made in one end, often with an instrument. This is not necessarily the best way to tie catgut, but originated as a means of conserving an expensive material. The catgut strand, although stretched and weakened somewhat, regains most of its strength and elasticity and is adaptable to this method of use. Wire also is stretched in tying but since it is a metal it retains its new form and does not regain its original length, diameter or elasticity. For this reason individual lengths of wire should be used for each tie and the two ends discarded when cut. Wire is easily handled in length of about 15 inches which is long enough to be held in two hands for the tie but short enough not to be clumsy.

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Physical Properties

STAINLESS steel wire is an alloy of 18 parts nickel and eight parts chromium with 74 parts of steel annealed into wire and available from surgical supply houses as 18-8 wire, in various sizes from a large No. 18 B & S gauge to a very fine No. 40 gauge. It is strong, flexible, non-irritating, non-corrosive and inexpensive. Wire varies less in size and strength than other suture materials and is not affected by autoclaving. Another characteristic is the great holding power of its knots. Preston[4] has demonstrated that when catgut is wet with saline and silk is treated with mineral oil and cut ends are left one centimeter long, the stability of the knots is increased up to 75%. Even when so treated and subjected to a strain carried to the breaking point of the suture, all commonly used knots in catgut slipped and untied. So did all granny, surgeon's, and square knots, and two thirds of the triple-throw knots tied with silk. When wire was subjected to the same test all these types of knots remained tied even when no ends were left beyond the knot. The great stability of the wire knot is due to the fact that, as the second loop is drawn down tight, the wire is bent and the surface is roughened. These rough areas interlock and greatly increase the friction within the loops. Friction is the chief factor in the holding power of a knot of any material.

Preparation of Sutures

PRIOR to operation, wire should be cut in even lengths of about 15 inches by unrolling it from the spool directly on to a board 15 inches long, taking care that the wire is not twisted. This is done by allowing the spool to rotate on a pencil or similar shaft as it is unwound. After several dozen rounds of wire are wrapped on the board, the wire is cut at both ends of the board and the straight lengths are threaded in small bunches through ¼-inch diameter glass tubes about 12 inches in length. The tubes are cut from stock tubing and are fire-polished on the ends prior to use. These tubes are labelled showing the size wire they contain. They are quite resistant to breakage and can be autoclaved with the instruments in the sterilizing tray many times over without injury to tubes or wire. Each tube of this diameter will hold several dozen small or medium-sized sutures, more than sufficient for a single surgical procedure. One tube each of several of the commonly used sizes, Nos. 30, 32, and 35, may be autoclaved routinely with

each instrument tray. Other tubes can be suitably wrapped, autoclaved, and held in reserve for the occasional case. Six sizes of wire, Nos. 24, 28, 30, 32, 35 and 38, in tubes, sterile and ready for use when called for, should be available in the operating room at all times. These are the sizes commonly used and correspond in size to catgut Nos. 2, 0, 00, 000, 4-0 and 5-0. Intermediate sizes are seldom used.

Use at the Table

TUBES of wire can be conveniently placed under a towel at the back of the Mayo stand, with one end near the edge or with loose ends of wire projecting over the edge. Care should be taken that the wire is drawn straight out from the end of the tube. If withdrawn at an angle so that the wire bends over the end of the tube, it will curl and be difficult to handle. Wire is easily threaded and, if two needles and two needle holders are kept in use, the instrument nurse can thread it as rapidly as required. The nurse prepares one set while the other is being used. It is not necessary, or desirable, to twist the wire after it is placed in the needle. It should be threaded from the concave side of the needle and about two inches of it doubled back on itself. The bend of the wire in the eye is then squeezed flat between the fingers by the instrument nurse. This bend will keep the wire in place in the eye of the needle, if the size is No. 32 or larger. Smaller sizes should be given a single twist to keep them in place and then be bent flat by a squeeze to keep the loop in the eye small and atraumatic. The wire should hang free as the needle holder is handed to the surgeon. The wire is allowed to trail to the assistant's side of the operating table as the surgeon brings it into the field. The assistant takes the end of the wire, keeping about five inches of it on his side of the field, allowing the operator the remainder of it for slack, which will bow upward when properly held. A skilled assistant's responsibility is to be able to keep just enough of this bowing to keep the loop in the eye of the needle. After the suture is placed the assistant holds his end tightly, and the follow-through of the needle holder after it is reapplied unthreads the wire and returns the needle to the instrument table in a single move. The assistant hands his end to the operator and the operator ties. The first loop is not drawn tight; only enough tension is used to approximate the tissue; the wire furnishes enough friction to hold the approximation nicely and allows the second loop to be pulled down tight with considerable force. This can be done without danger of the knot slipping and strangulating tissue. A two-handed knot is the easiest and insures that the knot is square. At this point it is well to recall that the mechanism of tying a square knot and a variety of slip-knot called the "lark's head" is the same except for the direction in which the hands are moved as the second loop is pulled down. A single hand tie sometimes catches as a "lark's head" and will not convert to a square knot as silk or cotton will usually do when the loop is finally pulled in the right direction. For this reason a one-hand tie should be avoided. Wire, being small, tends to catch in the box lock of a needle holder and many needle holders do not hold wire well in making a tie so a needle holder tie is apt to be unsatisfactory. The resultant short lengths of wire and uneven ends are also objectionable. As has been pointed out, a single throw square knot is as strong as the suture itself, so a triple throw knot is unnecessary and no ends of wire need be left to give stability to the knot. In order to insure that no ends of wire remain, the cutting of the wires is usually left until the entire row is placed, the assistant controlling the loose ends in a group, adding to it as each suture is tied. Having precut wires of equal length and tying the knot in the middle of the wire, facilitates this. It is unnecessary and time consuming to place hemostats on the ends of each suture. With all sutures of a row in place, they are held up in one hand while wiping downward along the group of wires with gauze, to clear the knots of fat so that each one is plainly seen, as the wire is cut as close as possible. The handful of wires resulting from this cutting can then be disposed of in the floor bucket. If each suture is properly cut on the knot the gloved finger can be run up and down the suture line without injury to the glove. This should settle any objection that may be raised against leaving wire ends buried in a wound. Wire of No. 32 size and smaller is not particularly hard on scissors, but if wire is used extensively a special scissors should be provided. An ordinary dressing scissors with one sharp and one rounded point is statisfactory and will stand up a surprisingly long time before becoming dull.

Inguinal Herniae

THE METHODS of repairing inguinal herniae do not differ from those which might be chosen when other sutures are used. One may employ a Ferguson, Bassini, Halstead, fascial graft, or modifications of any of these procedures, depending on the type of defect and the personal preference of the surgeon. No. 35 wire is usually used throughout for sutures. This No. 35 wire has the same diameter as 4-0 catgut with the strength of 0 catgut, 8½ pounds. A larger No. 32 wire is frequently used in the first row of sutures in large individuals or recurrent herniae. This is the size of 000 catgut with a strength of 17 pounds, comparable to No. 3 catgut or silk. The objection that such small sutures may cut through the tissue can be effectively answered. Cutting into the tissue depends on tissue reaction to the suture as well as on tension. Tissue reaction and cutting through during the healing period are minimal when wire is used and are greatest with large sizes of catgut. The softening and necrosis which occur when tension develops in tightly drawn thick sutures soon render the tissues incapable of holding any suture material. Only interrupted or figure-of-

eight sutures are used, the latter being preferred. These are placed as are two bites of a simple running suture, As it is tied the suture forms a figure "8" and the edges of the fascia are rolled together giving a wide surface of fascia in opposition. One is less apt to tie such a suture too tightly, and it avoids gaps of unopposed fascia between sutures. A size 9 or 10 full curved Ferguson needle is the preferable size and type of needle for use with wire in hernia repairs. If it is necessary to tie a bleeder directly beneath the skin, 000 catgut is used. Any suture in this situation may cause reaction. With catgut, this frequently occurs during the immediately postoperative period when the patient is under observation, is usually a small "stitch abscess," and may be tended to immediately. Wire causes so little reaction that it may be delayed for months, is usually a fibrous nodule, more or less tender, and may require excision. Such a late reaction is usually more disconcerting to both patient and surgeon than an early reaction more or less taken for granted. There is no objection to mixing catgut and wire in the same operation. The mixing of catgut and silk has been held to be inadvisable on the basis that catgut favors the onset of infection and silk favors its continuance. This need not be considered with wire which is regarded by some surgeons as the suture of choice in the closure of infected or granulating wounds.

Since wire is opaque to x-ray it is well to inform a patient that wire has been used and advise him that it will remain in the tissue and cause no harm. The purpose of this is to protect him from possible surprise discovery following x-ray examination at some future date.

IN THE PAST year we performed 62 inguinal hernia repairs in 55 patients using the above technique without a single wound infection even though there were three hematomas one of which followed dicumeral therapy for suspected but unproved phlebothrombosis. Seventy-three per-cent of the patients had less than 100° of postoperative temperature reaction and none had fever due to a wound complication. Seventy-eight per-cent required no dressing after the eighth postoperative day, and only one required dressings as long as 12 days. In the preceding year in one hospital in which we did most of our operations, 91 hernias were repaired using catgut. Only 20% had less than 100° of fever, and there were two wound infections. In the same period 95 cases were repaired with silk or cotton. Only 38% had less than 100° of fever and one wound infection was reported.

There have been no recurrences in our wire repairs but the interval is too short to be significant. However the first 68 cases in which I used wire, done in 1939 and 1940, were followed for three years. There was one recurrence. These were part of larger series of 235 cases reported by Agnew and Dulin,[5,8] performed by 18 different surgeons who for the most part were residents in general surgery doing their first herniorrhaphies. There were only 1.8% wound infections and 2.55% recurrences, which is an indication of the favorable results that may be anticipated when wire is used as the suture material.

Summary

A TECHNIQUE for using stainless steel wire has been presented, emphasizing the following:

1. Wire has greater strength for size than other suture materials and its knots have greater stability.
2. Wire should be cut on the knot, as loose ends are not needed for stability.
3. Only one tie should be used for each length of wire.
4. A two-handed knot, using the hands to grip the wire, is the tie of choice.
5. The figure-of-eight has advantages over the single interrupted suture.
6. Wire may be mixed with absorbable suture materials in the same wound.
7. Preparation of the wire in lengths suitable for this technique has been described in detail.
8. The physical and biological characteristics of wire and its application in the repair of inguinal hernia have been discussed.

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Practical Points on Skin Grafting

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THE transplantation of skin is a surgical procedure of value to the surgeon. Its importance in hastening the healing of integumental defects, and preventing as far as possible, cicatricial contracture, is emphasized.

A skin graft may be defined as the full thickness, or a portion of the thickness of the skin, without subcutaneous tissue, cut free from its original bed and transplanted to the desired site. It may be obtained from almost any portion of the skin surface, and the region from which it is taken has little if any effect on the success or failure of a graft.

Before attempting to transplant skin, however, cognizance must be taken of the general condition of the patient, the donor area, and the type and nature of skin loss. Areas which may be grafted are fresh operative wounds, granulating surfaces, or healed scarred areas. The anatomy of the affected parts and the degree of tissue destruction, not always appreciated, are of primary consideration and often determine the type of closure.

When the denuded area is over a bony or unyielding structure, the greater part of healing is by scarred epithelium, which grows in from the periphery. If, however, the denuded area is anterior or posterior to a joint, the area heals by contractural fibrosis. Naturally, the larger the regional surface destruction, the greater the tendency to contracture, and limitation of flexion or extension. Splinting and correction of position does little if anything to prevent the contraction, acting like a rubber band, producing a constant elastic pull. The only prophylaxis against the formation of healed contractures, is early and complete resurfacing of the wound, with a sheet of skin as thick as one dares use on a granulating surface.

To ascertain the amount of skin loss, it is necessary to determine the gape of skin after all contracting scare has been removed and the joint placed in overcorrection. To give permanent correction, one must resurface with a skin graft of sufficient size to cover the denuded area.

An individual suffering a denuding injury, such as that caused by a severe burn, tends to lose blood plasma, and become dehydrated. Thompson, Ravdin, and Frank[1] have reported the effect on wound healing when blood proteins are diminished. Harvey and Howes[2] found an increase of fibroblasts, with a high protein diet. To correct hypoproteinemia, whole blood or blood plasma, amino acids, and predigested foods are all administered.

One must guard also against dehydration, with its symptoms of thirst, dryness of mouth, and elevation of temperature. Acidosis and alkalosis will tend to occur, with a rise in non-protein nitrogen in the blood. If vomiting occurs, the blood chlorides are depleted. The fluid requirement for surgical patients, as determined by Collier, Dick, and Maddock[3] is the normal amount, plus any abnormal loss as from vomiting, diarrhea, and hemorrhage. Computation is as follows:

Normal fluid requirement:

Water of vaporization	2000 cc.
Water for urine	1500 cc.
Water for feces	150 cc.
Total	3650 cc.

Abnormal fluid loss calculated, as follows:

Fluid loss from vomiting, diarrhea, wound exudates, etc.	1000 cc. ± (plus or minus)
Water for evaporation	2000 cc.
Water for urine	1500 cc.
Water for feces	150 cc.
	4650 cc. in 24 hours

If dehydration is present when seen, an amount of fluid equal to 6% of body weight is required, or as follows:

Normal fluid requirement	3650 cc.
6% of individual of 75 kilograms	4500 cc.
	8150 cc. in 24 hours

For most routine lesions of the extremities, skin taken from the abdomen, thigh, or buttocks is used, but when an area such as the face is to be grafted, a selected donor area of the skin of the same texture, color, and thickness as the recipient site is employed. If a hairbearing graft is desired, it will be taken from the scalp or pubic area; if to the face, skin from behind the ear, or from the upper lid to replace a lower lid. If a non-hairbearing area is desirable, a graft from the inside of the arm or thigh may be selected, although the color will vary from the face.

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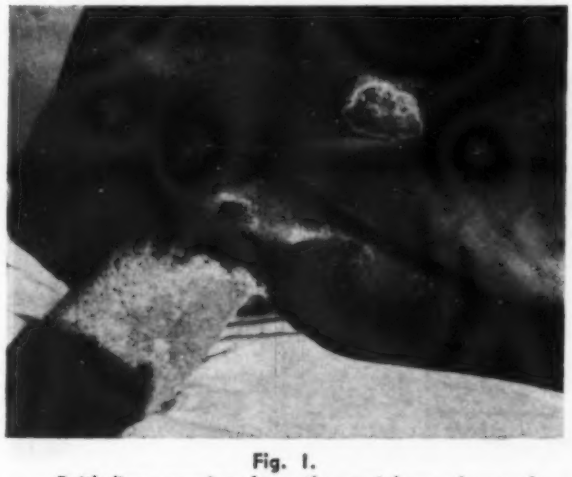

Fig. 1.
Epithelium growing from the periphery of wound toward center

DeNouy[4] found a faster rate of healing in young animals, and this observation has been demonstrated in skin graft takes. The certainty of a successful "take" is highest on an aseptic base, such as a fresh accidental wound or a freshly denuded surface, following a clean operation. When these conditions are met, a thick graft is the ideal, and duplication of the surrounding area will be more nearly approached than with a thinner graft. Granulating areas produce a high percentage of failures with thick grafts, but a thin graft or one of intermediate thickness will survive, and result in a high percentage of full takes, the thickness varying with the cleanliness of the recipient area. Unclean granulations are not desirable for placing a graft, and they should be made as clean as possible before grafting, by repeated wet dressing.

Factors influencing a successful graft are contact between the graft and the base. It is much more difficult to obtain apposition with a concave surface than with a convex surface. In grafting the forehead, contact is easy, while the anterior of the neck produces several difficulties, such as tendency of the graft to pull away, and movement of swallowing. Blood supply in the recipient area is essential, and the more nearly normal, the higher the percentage of "take" which may be expected. Areas which are scarred, should be dissected down to normal tissues, otherwise a degree of uncertainty develops, as to whether the graft may obtain sufficient nourishment to grow and mature.

When to resurface a denuded area, is dependent upon the etiology. Fresh, clean, operative, or traumatic wounds will respond to immediate grafting; scarred wounds may or may not. If hematosis is complete and blood supply is ample, grafting will probably be successful, but if the contrary is true, the "take" will be enhanced by placing a sterile gauze dressing in the wound for a few days, to stimulate granulations and control bleeding. Acute traumatic wounds, if seen early, may be cleansed, irrigated, debrided if indicated, and followed by immediate graft. Infected wounds requiring cover will, of necessity, wait until the infection is under control.

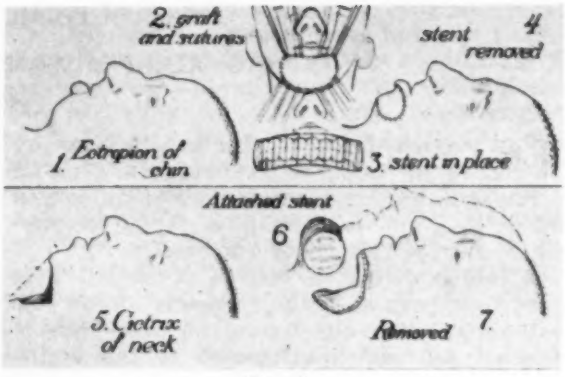

Fig. 2.
Gauze roll used as a stent to apply pressure to a skin graft

If mildly infected, a waiting period of two to three weeks will be required, to clean the wound sufficiently to result in control of the infection, and elimination of the slough. In burns, a period of three to five weeks is usually required.

When grafting skin on granulating surfaces, they must be clean, firm, a healthy cherry red, and not too exuberant. The denuded area must be free of slough and gross pus. The bacterial cell count is not as informative as is the appearance of the wound. In preparing a wound for grafting, a simple dressing, such as a vaseline gauze dressing, is used up to a few days before operation, followed by wet dressings. The wet dressings consist of saturated solution of boric acid or normal saline, with the wound dressed once in 24 hours. If the granulations are kept wet, they will become waterlogged, and the surrounding skin macerated. If the dressing is allowed to dry out, the granulations lose their boggy appearance and a more satisfactory "take" may be anticipated. When the wound is extensive, as in a burn, daily saline baths will tend to cleanse the wound, and make care of the patient much simpler. Many solutions are available, but saline baths and boric acid wet dressings will be found most convenient and practical.

The general condition of the patient will influence the result. If anemia is present, a blood

Fig. 3.
Wound ready for skin grafting and skin placed

transfusion, repeated if necessary, may be employed before operation. Blood chemistry should be checked, and any deficiency noted and corrected. Infection will be treated as indicated.

Padgett,[5] and others, have shown that the main reason for failure of early skin grafting, has been infection which frequently develops beneath the graft, resulting in either a partial or total loss. Padgett reported one-third of grafts on granulations resulted in 21% or more of the graft being lost.

When the base of granulations is relatively new, these grafts have a greater chance of success if not removed, but in areas deeply scarred the central blood supply is diminished and will result in a loss of the graft, unless the scar and granulations are removed down to normal tissue, with a good blood supply.

In healed or unhealed contractures, which are several months old, the granulations and scar are removed by wide excision, permitting correction of the deformity by the application of a fairly thick split graft. The involved member is then placed in overcorrection. Thus the condition is cared for in one operation.

A full thickness skin graft is, as a rule, the graft of choice, but its use is limited to areas which are relatively small and the possibility of failure is, therefore, negligible. The principal factors involved in obtaining a satisfactory graft are first, a sterile field; there is diminished resistance of the graft through lack of nourishment, until the graft has healed. Secondly, a dry base on which the graft is placed is essential. Hematomas under the graft will result in a loss, with the increased chance of infection. All the fat should be removed in cutting the graft from the donor area. The graft is cut according to pattern and sutured into the defect for fixation. Pressure is applied to maintain sufficient contact between the recipient area and the raw surface of the graft at all times. Concave surfaces are especially liable to have the graft pull away from the base, and for this reason special precautions are essential to prevent this tragedy. There are several precautions that may be used: fixing the graft by means of sutures across the surface of the graft; the use of a stent to hold this graft in place; and a snug bandage to hold the graft in contact with its base.

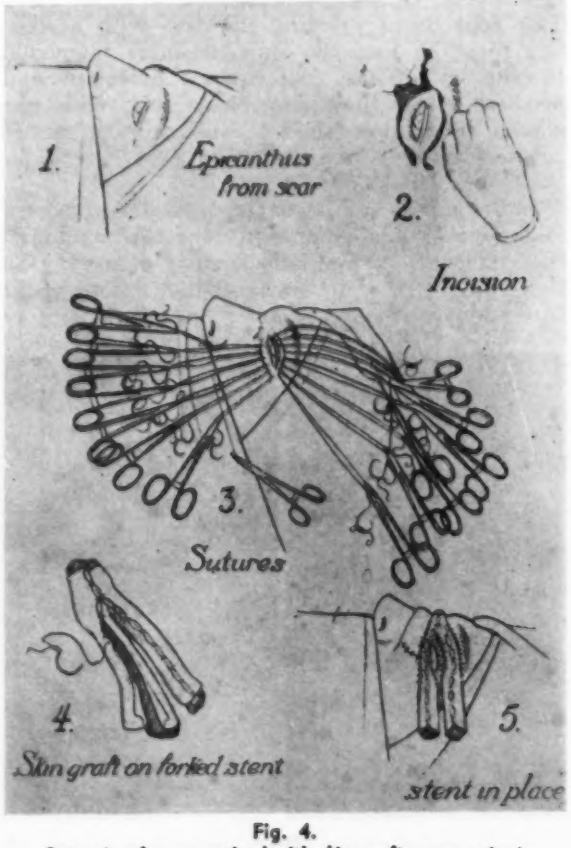

Fig. 4.
Ectropin of eye repaired with skin graft on wax stent

Fig. 5.
Wax stent used for holding skin graft

The dressing of any skin graft is essential for success. Blair,[6] in 1924, reintroduced the sea sponge which is resilient, pliable, and gives a uniform pressure over an uneven surface, if the bandage is placed with proper tension. Later the sponge becomes hard, forming a splint, and adding immobilization to the graft. Later, Brown used mechanic's waste in place of the marine sponges and found that it accomplishes the same things, and more economically.

Stents are effective means of obtaining fixation and pressure. They may be fashioned from dental wax, or either marine or lint sponges. The wax stents are reserved for inside the mouth, about the eyes, and lips. In areas requiring larger grafts, the marine sponges or lint are used because the weight of wax is prohibitive.

When marine sponges or lint are used, interrupted sutures are employed and left long around the graft, catching it together with the skin edges, at intervals of approximately one centimeter. Two layers of petrolatum gauze are placed on the graft. This is followed by three or four layers of dry gauze, or mechanic's waste is selected, to build up sufficient bulk to form pressure and fixation when the sutures are tied. The wax stent is applied slightly differently, the graft sutured around the wax with the raw surface outward. Then the sutures are placed in the edge of the skin at intervals of about one

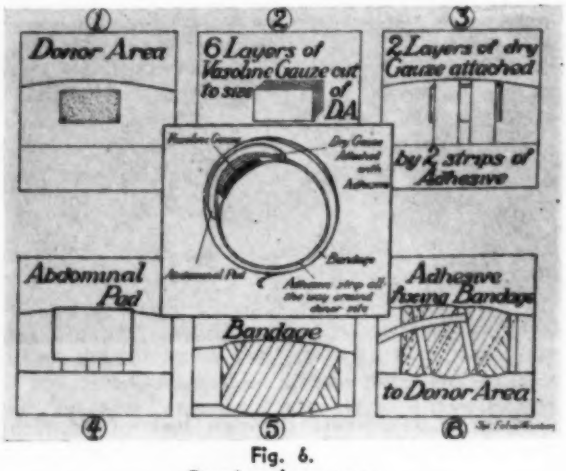

Fig. 6.
Dressing donor area

centimeter. The skin covered stent is then placed in the gutter and the sutures placed over the stent to the unsutured edge of the wound, and tied.

The stent is left in place as a rule, for a period of four to nine days; however, this may be prolonged, or the time may be shortened to as much as 48 hours, resulting in a successful graft.

The dressing of the donor area is of considerable importance. Six layers of petrolatum gauze are placed over the wound and trimmed so as to just cover the raw surface. Two layers of gauze are then placed over the petrolatum gauze. This is firmly fixed with adhesive tape, extending entirely around the leg; if on the trunk, it is firmly fixed around the body. Then an abdominal pad is placed over the donor area and fixed with a roller bandage, and this in turn fixed with adhesive tape. This dressing need not be disturbed for nine to 14 days, depending upon the thickness of the graft. As a rule the donor area is healed at the end of this time, requiring no further dressing.

Occasionally, when a deep graft has been cut, a heavy scar suggesting a keloid results. The scar is closely observed and if a keloid is developing, the donor area is subjected to irradiation, as a prophylactic measure.

The care after the first dressing, is predicated upon the condition of the graft. If the graft is dry, and blisters and blebs are absent, one layer of vaseline gauze is placed upon the wound, with about eight layers of dry gauze superimposed, and firmly bandaged for about one week. If the graft is moist or any blebs or blisters are present, wet boric acid dressings are applied and changed once or twice daily. As long as blebs are present on the graft, especially a full thickness graft, maintenance of pressure is advisable.

The return of sensation has been studied by McCarroll,[7] and his conclusions are that sensation returns to all parts of the grafts simultaneously, and the thinner the graft the earlier sensation may be expected. He found that light touch appeared in 22 days and complete sensation at the end of 60. Kredel and Phemister[8] found little return of sympathetic function in free skin grafts.

The surgeon will see two types of lesions; the unhealed and the healed. The unhealed lesion will require cover as quickly as possible. Through necessity, the thinner graft will be used, to insure a successful cover. After all areas have healed, definitive care may be obtained with the graft which more nearly approaches the ideal in color, texture, hair-bearing, etc. New granulations will allow the graft to grow better if the graft is placed on the granulations directly. Granulations on a thick scar base will require excision, to relieve the contraction and to obtain a more perfect blood supply. The healed lesion, will require excision of all the scar, and replacement with as thick a graft as is possible to apply.

The question is posed by surgeons, regarding the transplantation of skin from one individual to another. Our experience has been limited to 27 patients who were burned, and the result has been a complete melting away of the graft after 10 days, as the short period, with 38 days as the maximum.

Color matching of skin grafts and flaps is desired at all times, especially when these grafts and flaps are applied to the face. The skin color is not always that which is desired, and in the free grafts we will experience a color variance from a dead white to a deep brown. Gertrude Hance et al[9] reintroduced tatooing to these areas. This consists of pricking the skin with needles and carrying into the skin insoluble pigments. Insolubility of the pigments is essential, and needless to say they must be non-poisonous and stable. The appearance of the surgical repair can be definitely improved, and with care, complications will be rare.

Individuals with a considerable integumental loss and a limited donor skin, require a maximum coverage with a minimum amount of skin. The use of the skin sectioned into small pieces about the size of a postage stamp, produces a more

Fig. 7.
Full thickness graft tatooed

Fig. 8.

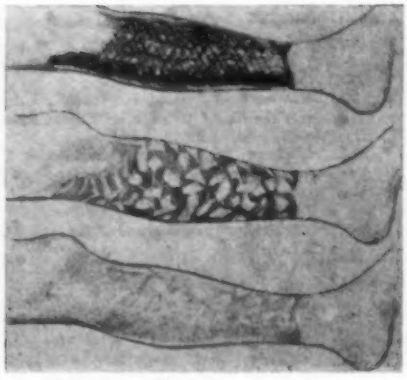

Fig. 9.

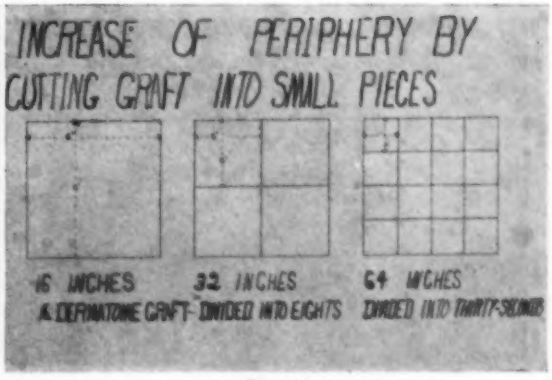

Fig. 10.

Fig. 8: top, patch grafts spreading to cover denuded area; bottom, after grafts have spread and joined. Fig. 9: patch grafts applied to granulations on the leg. Fig. 10: diagrammatic drawing showing increased periphery obtained by cutting graft into small pieces

rapid coverage. Approximately twice the granulating surface may be covered by this means, and the percentages of takes by this method is nearly 100%, since any oozing from the bed is allowed to escape at the periphery of each graft. Time used in suturing the grafts is dispensed with, as the grafts are laid directly on the granulations and become fixed in a few minutes. If the physical condition is critical, the patient need be kept under anesthesia only a sufficient time to cut the grafts. The grafts being cut in the usual manner and the more irregular the pieces of graft, the longer will be the growing periphery. A distance of approximately one centimeter is left between successive grafts. The advantage of this method is that cover may be obtained in relatively dirty, infected wounds, rapidly and quite early.

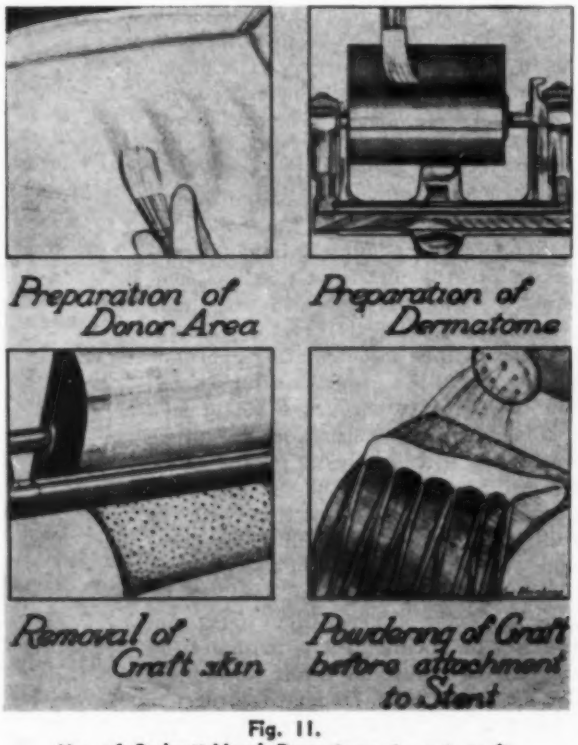
Preparation of Donor Area
Preparation of Dermatome
Removal of Graft skin
Powdering of Graft before attachment to Stent

Fig. 11.
Use of Padgett-Hood Dermatome to cut graft

The use of the pinch graft is employed in a limited field, where larger grafts have been unsuccessful or patients severely burned, and where prolonged anesthesia would be contra-indicated. The cosmetic result leaves a lot to be desired and the area stands trauma badly. Considerable contracture occurs between the grafts, and as time goes on their use by more experienced surgeons is becoming lessened.

Refrigeration of skin grafts is seldom used, although the technic is simple, and its application is limited to special indications. Essentially these indications are preservation for a later date, of any excess skin that may have been left over, and preservation of skin removed, followed by rapid deterioration of a patient following removal. The skin is preserved by wrapping the graft in vaseline or Xreaform gauze to prevent drying out, and then placing it in a refrigerator at approximately 4° C.

The fixation of skin grafts by thrombin and plasma has been discontinued, as, in our experience, little if anything was accomplished by its use. The graft becomes fixed in a few moments to its base, and if proper hematosis is present, no advantage has been observed from the use of thrombin plasma.

To cut large grafts, especially in patients with little subcutaneous fat, on children or on the abdomen, the use of the Blair suction box is adequate to secure tension. Or the skin may be put in tension between two basswood boards and a pull made in opposite directions. Many will prefer the Padgett-Hood dermatome after the skill necessary for its use has been perfected.

Summary

THE value of skin grafting in the healing of integumental defects and the prevention of cicatricial contracture, with some essential points on its successful application, are discussed.

Major importance is attached to methods of cutting and placing of the graft, and recommended surgical technic is described.

Fig. 12.
Blair method for cutting skin graft

Care in dressing of the wound and donor area, is explained in detail with special emphasis on pre-operative and postoperative care of the skin graft.

Our experience has proved that anatomy of affected parts and evaluation of tissue destruction prior to skin grafting procedure are often determining factors in the type of closure and the success of a graft.

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New Post-graduate Training Course in Industrial Medicine

DR. MAX R. BURNELL, Medical Director of General Motors Corporation, DR. HENRY F. VAUGHN, Dean of the School of Public Health of the University of Michigan, and DR. CLARENCE D. SELBY, Resident Lecturer in Industrial Health at the University of Michigan, have worked out a new post-graduate training program in industrial health techniques for young physicians who have completed their internships. This program will compare with the resident hospital training many physicians now undergo in other fields of medicine and surgery. The physician will be in the employ of General Motors for a period of 12 months; eight months will be spent in the Medical Departments of various General Motors plants, and four months at the University of Michigan School of Public Health. In the Medical Departments the physicians will become familiar with the General Motors Medical Service Programs, working with industrial physicians and technicians who have had many years of career experience, and at the School of Public Health at Ann Arbor they will study public health administration, environmental health, epidemiology and health economics. Any physician who has completed his hospital internship and is interested in industrial health work may apply for this training through the General Motors Medical Director, General Motors Building, Detroit 2, Michigan. Applications will be accepted after February 1. Physicians now serving their internships may begin the program after July 1. DR. BURNELL is quoted: "This new program, designed to encourage young men to enter this fast-growing field of industrial medicine, has much to offer and we are happy to be cooperating with the University of Michigan in its inauguration. The progress that has been made in safeguarding the health of the industrial worker during the past decade has been amazing. We are confident that, with the introduction of this type of program, resulting in improved training for those interested in industrial health, we can make even greater gains in the years to come." The establishment of this course is news. *Chicago Tribune*, January 19, 1950, says, on its front page: "The General Motors Corporation today announced that, in cooperation with the University of Michigan, it is inaugurating a new type of post-graduate training program in industrial health techniques for young physicians who have completed their internships. Under the program, first of its kind to be established in the country, the physicians will be in the employ of General Motors for 12 months."

Alcohol and Education

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PHYSIOLOGISTS attempting to restore the chronic drunkard to normal life have a most difficult job. I believe that if a strong educational program were begun with young people in the seventh and eighth grades and carried on through high school and then continued even through college, much sorrow, time and money could be saved. Every state has a law requiring that public schools inform pupils of the danger of alcohol and narcotics. In Illinois the statute provides: "All pupils in such schools below the second year of high school and above the third year of elementary school work or in corresponding classes of ungraded schools shall be taught and shall study this subject every year from suitable textbooks in their hands, not less than four lessons a week for 10 or more weeks of each year, and must pass tests in this as in other studies. In all such schools pupils in the lowest three elementary years, or in corresponding classes in ungraded schools, shall, each year, be instructed in this subject orally for not less than three lessons a week for 10 weeks in each year, by teachers using textbooks adopted for such oral instructions as a guide and standard. The textbooks shall be graded to the capacity of the fourth year, intermediate elementary and high school pupils, or to the corresponding classes in ungraded schools. For students below high school grade the textbooks shall give at least one-fifth their space, and for students of high school grade shall give not less than 20 pages, to this subject. The pages on this subject in a separate chapter at the end of the book shall not be counted in determining the minimum. In all State normal universities and teachers' colleges, teachers' training classes and teacher institutes, adequate time and attention shall be given to instruction in the best method of teaching such subject, and no teacher shall be certified who has not passed a satisfactory examination in this subject and the best methods of teaching it. Any school officer who neglects or fails to comply with this section shall forfeit and pay for each offense the sum of not less than $5.00 nor more than $25.00."—*Laws 1945*, p. 1331, sec. 27-10. Let us insist that the school laws be enforced.

THERE is a crying need for cooperation in the establishment of a better educational program on the subject of alcohol: its use and (especially) its abuse. This program, aided by means of radio, television, newspapers and magazines, should be given by people well qualified in the *scientific* aspects of the problem. What we need to start such a program is an *aroused* citizenry. Everyone is familiar with the excellent dissemination of information on diabetes, TB and cancer. If the public could be impressed with the facts about alcoholism: how it becomes a serious and almost incurable illness or disease, and that it requires treatment as stringent as diabetes, malaria and other major diseases, we could then create enthusiasm for an educational program of prevention. As it is now, the program in our schools regarding alcohol is handled in an almost indifferent or perfunctory manner.

OUR young people are capable of recognizing the significance to society of the too frequent divorces, broken homes, and poverty caused by alcoholism. Many of them have it in their own homes. To illustrate what an aroused public can do in such matters, take Miami County, Ohio. There the people recognized that something was radically wrong. The divorce rate was double the United States rate of a community its size: one divorce for every two marriages. They had seen, and knew, how unhappily alcohol had broken up their homes, and how this adult delinquency and indifference to child welfare caused like problems in the younger set. So they raised money to organize a Mental Hygiene Association. They realized how inadequately trained most of the teachers were in regard to teaching both young and old the new creed of healthy minds. They then agreed to pay half the tuition for any teacher or teachers who would take an extension course in mental health. The responsible teachers agreed that families had to be mentally stronger and happier emotionally for a child, or children, to feel security through care and affection. The plan proved successful, for the people found out that, as psychiatrists know, juveniles will react with good or bad behavior to attract attention. This should be a lesson to every community in the United States.

NOW for some facts regarding the knowledge young people should have concerning alcoholism: For the fiscal year, ending June 30, 1948, there were produced in the United States 60,373,926,165 six-ounce glasses of fermented liquors. Up to June 30, 1949, there were in bonded warehouses, 602,925,861 proof-gallons of whiskey. The total of proof-gallons in bond, including gin and other spirits, was 677,343,619 gallons. A standard proof-gallon is a wine gallon of an alcoholic content of 50% of ethyl alcohol by volume. The proof of the spirits is twice the percent of the alcohol by the volume of ethyl alcohol. Up to June 30, 1949, there were withdrawn, tax-paid at the rate of $9.00 per gallon, 40,845,714 proof-gallons. There were produced up to June 30, 1949, for the fiscal year, 266,542,499 tax gallons, of which 141,766,697 gallons were taxed at the rate of $9.00 per gallon, at a revenue of $1,275,900,273.

This would cost the American public from 28 to 128 times this amount according to the manner in which it was dispensed. In addition to the astounding amounts produced in the United States there were imported up to June 30, 1949, for the fiscal year 370,429 proof-gallons of whiskey and other distilled liquors. So much for cost.

ALCOHOL is only a temporary stimulant, it depresses the functions of the central nervous system. The senses of vision, hearing and touch are dulled. The feeling of responsibility is diminished. This affects the office man as well as the man industrially employed. Alcoholics Anonymous is not the answer. Neither is the new Antabuse treatment of alcoholism, which checks the consumption of alcohol, but still needs the active cooperation of friends and relatives and the support of intensive psychotherapy.

We can hope to conquer our "Number One Problem" only by an intensive educational campaign, giving the scientific facts regarding alcohol in an interesting and understandable manner to *young* people.

What Would YOU Do?

JUST what *can* be done? What would *you* do if you were given the job of trying to prevent accidents due to personal factor? How would you go about taking a fool from behind the wheel *before* he had had two or three accidents? One might take his license to drive away from him *after* the accidents, but rarely is it possible to detect these accident prone persons *before* the accidents. If such person were deprived of his driving rights after passing a driving test it would clearly be an infringement of his constitutional rights, and both you and I would defend him—*before the accident.* How shall we prevent a man from dozing at the wheel occasionally? How shall we insure ourselves against the fellow who momentarily has his attention directed away from the job of driving? How shall we prevent a driver from slapping at a bee that has come through the window? Or from rubbing his eye when he gets a cinder in it? Now there *are* persons who never do these things, but unfortunately they are all dead. There are persons who never hurry; they never need to hurry because they don't amount to anything anyway. There are others who hurry when there is no need to do so, and so far as I know there is no way to compel them to change their habit. The most dangerous combination of these personal factors is set up when Mr. *Nobody* is going *no place* to do *nothing,* but what can be done about it in this free country? Mr. Nobody insists that he is definitely Mr. Somebody, that he is on a mission of great importance and that he must get to his destination in record time. And so far as I can know at the time, he may be entirely right about it. Even if I felt sure that he was Nobody going no place to do nothing, there isn't a thing that I or anyone else could do about it. How can we require a man to change a worn tire before it blows out and slithers across the road into our path? The man has the right to try to get the best possible mileage out of those tires. How can we know that the reaction time of the man we are meeting has been slowed by alcohol and that his field of vision has been narrowed and his judgment impaired by the same agent? He has a right to drink, you know, and he does drive when drinking—all too frequently....

—From "The Personal Factor in Accidents," in *Monthly Bulletin,* Indiana State Board of Health, December, 1949.

Industrial Head and Back Injuries
—The Neurological and Psychiatric Viewpoint—

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IT IS GENERALLY agreed that industrial head and back injuries are the most difficult to treat and cause the longest disabilities in industry, so far as percentages are concerned. Recent statistics reveal that psychiatric disorders have moved into the number one place on the list of public health diseases in this country. It is, therefore, important that the head and back injuries in industry be considered from a psychiatric viewpoint. There are three distinct categories of psychiatric disorders in industry with which we have to deal: traumatic neurosis, psychosis, and malingering.

Traumatic Neurosis

ORIGINALLY the term traumatic neurosis was applied only to the patient with a head injury who had recovered organically but who continued with vague symptoms such as headaches, dizziness, and other psychosomatic complaints. But the term has taken on a broader meaning, and now anyone who has had even the mildest injury and then developed a nervousness falls under the classification of traumatic neurosis. Personally, I would favor the term "neurosis due to trauma." You are all acquainted with the patient who has been under your care for some time, who has nothing organically wrong with him, but who still gives complaints which you report as functional and subjective. A thorough psychiatric examination in such a case might reveal that the individual was apparently well-adjusted up to the time of the injury, but that the injury released certain underlying factors which eventually produced a neurosis. Many times, however, this is produced not by the injury itself but by the people surrounding the injured man. Fear is one of the greatest causes, and, if the fear is intensified soon after the injury, the patient will develop a neurosis. We are able today to treat neuroses, and for that reason if an industrial physician suspects soon after the injury that there is a neurotic factor, the patient should immediately be referred to a specialist in mental and nervous diseases. It is also important that when a man is injured no definite statement be given by the doctor or the treating nurse, because many times thoughtless remarks may be an important cause for the development of a neurosis.

Psychosis

PSYCHOSIS, or mental illness per se, can develop in industrial cases only after an organic head injury. We often see psychosis due to traumatic epilepsy; but any psychosis which develops in consequence of an industrial injury other than one due to organic brain damage is in no way connected with the original injury. Very frequently we see a patient who was psychotic even prior to employment, and whose psychosis was not detected by the personnel department. If such an individual encounters an industrial injury, his psychosis will become apparent, and may be misjudged as relating to the injury.

Malingering

THIS is one of the most difficult and, unfortunately, the most common picture seen after industrial injuries. The malingerer deliberately falsifies about his own condition. Many times it is easy for an astute examiner to trip him up. However, if his malingering has been going on for a number of years, the condition may have become so attached to the individual that it is difficult to differentiate it from a true neurosis. From my experience, I do not feel that these patients have a neurosis, but have developed what I call an unconscious exaggeration, or unconscious malingering. In other words, they originally exaggerated consciously, and over a period it became so much a part of their personality that it is now difficult to differentiate it from a true neurosis. The history is of great help in arriving at a conclusion. Malingering will occur at any age, and at any intelligence level, and is equally distributed as between males and females. Since there is always the possibility that industrial injury cases can develop into litigation cases, financial benefit is one of the causes of malingering.

Head Injuries

FOR the sake of simplicity, I consider that a head injury is any injury in which there is a direct blow to the skull. It is important for the first examining physician to obtain an adequate history: how the patient was struck; if he was rendered unconscious; and his immediate symptoms after the injury. A skull x-ray should be taken as soon as possible, preferably a stereoscopic view. An electro-encephalogram should also be obtained. The examination should consist of a thorough physical, which should include the eyeground examination and a detailed neurological examination. In my opinion a spinal puncture and an air encephalogram are unnecessary and contra-indicated. It has been my experience, with many cases, that they have unnecessarily prolonged the disability period. It is of utmost importance for the first treating physician, if he does not find any organic disability, to refer the patient during the first month after the

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injury to a specialist in mental and nervous diseases, who should be asked to define if the patient has an organic brain injury, or if he is neurotic or a malingerer. As you know, many of these head injury cases have been "kicked around" for years, have been on the compensation rolls too long, and will give the I.A.C. the right to make an award for disability or treatment. What I am trying to bring out is that if a head injury case is managed properly at the beginning, it should be disposed of one way or another at the earliest possible time. I would like to present examples of head injury cases:

CASE 1: L. C., a 32 year old female. One month before her first examination in my office, while she was working on a fruit belt, she stooped and a fellow employee next to her reached for an orange box. This box fell and hit her head and right arm. She was rendered unconscious for a short time and her forelady had to catch her and help her to the restroom. There she began to shake and lose control of herself. Her complaints were headaches, especially in the left occipital region, dizziness, and pain in the neck. The physical examination was essentially negative, with the exception of a complete right-sided hypesthesia. An electro-encephalogram was not conclusive. She received psychotherapy and returned to work exactly three months after her injury. The diagnosis was traumatic neurosis.

CASE 2: A. C., white, male, age 36 years; occupation, carpenter. About four years ago this patient, while in the bottom of a railroad car, was struck by a 4 in. x 4 in., 12 ft. long post. He was examined by the local doctor and a diagnosis of brain concussion and fractured skull was made, which was symptomatized by dizziness, headaches, weakness, loss of vision, loss of hearing, tenderness of the skull, and nausea. The diagnosis of fractured skull was later refuted because this man had had brain surgery at the age of three. He was examined in 1947 and at that time it was the impression of the examining specialist in mental and nervous diseases that he was suffering a neurosis. When he was seen by this examiner, he showed definite paranoid delusions. "I am taking my life into my own hands if I enter the hospital building of the sanatorium unless you are present. The insurance company has sent a man to the sanatorium for the sole purpose of giving me the medicine you ordered, but this insurance man now has told all the attendants not to give me the medicine." The patient further stated that he heard someone saying to him, "there is the insurance man talking to the attendant about your medicine." The patient was unable to identify who told him, and he also was unable to describe the insurance man. The physical examination was completely negative, including an E.E.G. The diagnosis was psychosis unclassified.

Back Injuries

FOR consideration here I would like to refer to a back injury as any case in which a patient complains of back symptoms in consequence of his original injury. Here, again, a thorough physical examination, x-ray of the back, and complete neurological examination immediately after the injury will give some clues as to its extent. It is contra-indicated to do a spinal tap or even a myelographic study, as these procedures will only prolong the disability period. Industrial intervertebral disk syndromes are infrequent and often misdiagnosed. Elective surgery on industrial backs, especially if a diagnosis of intervertebral disk has been made, has brought good results in only a small number of cases. It is important to remember that complaints of back symptoms are common in neurotics; and my own experience has shown that if these patients are treated from a psychiatric standpoint, their back symptoms will disappear. It would, therefore, be ill-advised to do surgery on a neurotic back. Psychotic patients who have delusions regarding their back symptoms have frequently undergone surgery. I do not need to tell you that the results were nil. Since it is very difficult to disprove a patient's claim of back symptoms, back pain is frequently found in malingerers. There, again, a thorough physical examination will give some clues; as, for instance, the patient who is unable to reach the floor in forward bending by 20 inches, in a sitting position is unable to touch the tips of his toes by only five inches. This discrepancy will give a certain clue as to the honesty of the patient. Also, if his backward movements are completely limited but his lateral and rotating movements are normal, one should become suspicious that the patient is not giving the proper physical findings. If during the examination he does a lot of grunting and clenching of teeth, especially when he is asked to move his extremeties while in a prone position, and if on active movement of both lower extremities he uses voluntary muscle spasm to oppose the examining physician, one should suspect him to be a malingerer.

SOME interesting statistics have been compiled by A. H. Scholz, M.D., Chief Surgeon, Pacific Electric Railroad Company. Dr. Scholz reported the results of 823 back x-rays performed on job applicants. Forty-eight men, or 6% of all x-rayed, or 31% of the rejected group revealed a narrowed disk space between the fourth and fifth lumbar vertebrae. This is one of the most important findings I have heard in recent years, and certainly proves that not all intervertebral disk syndromes are caused by industrial injuries. A study which I reported in November, 1948, to the Western Orthopedic Association meeting in San Francisco, revealed that out of 52 industrial back injuries, six cases were frank psychotics, 10 were definite neuroses, and 24 were diagnosed as malingerers. Of these 52 cases, 47 had been diagnosed incorrectly as intervertebral disk

syndromes. Eleven of the 52 had been operated on by simple laminectomy. Lately a new method has been found to diagnose, with reasonable assurance, an intervertebral disk. Electro-myography is used successfully in determining lower motor-neuron disease. Any nerve disability due to even the slightest pressure by a slipped intervertebral disk can be diagnosed.

CASE 3: H. S., white, male, 48 years old. This patient, while working in an aircraft factory, lifted a heavy object and suddenly felt a "snap in his back." The injury occurred in November, 1944. According to a neurological examination done in February, 1945, there were no physical or neurological signs to indicate that he was suffering an intervertebral disk. However, he was operated on for intervertebral disk a week later. No disk was found, and the area of the laminectomy was fused. In March, 1948, he was observed by a private investigator, and movies were taken which did not reveal any limitation of his back motion. In fact, he was observed touching the ground with full back motion. The physical examination disclosed that all back movements were limited, as were the straight leg raising and thigh flexion. He was given a sodium amytal interview in which he stated that he had not felt better since surgery and that he was getting worse. The physical findings were more exaggerated than on a conscious examination. It was my opinion that this patient was malingering.

CASE 4: N. H., white, male, 61 years of age; occupation, carpenter. About 18 months prior to the examination this patient fell about five feet from the roof of a house, landing on his back on a nearby platform. He was first examined by the company physician who did not find any injury. He was re-examined by his own doctor who diagnosed fractures of the facets of the fourth lumbar vertebrae. He was treated adequately from an orthopedic standpoint, but was unable to move his back and to walk properly with his right lower extremity. When he first was seen 18 months after the injury he was wearing a canvas belt, and was supporting himself with a walking cane. He had all the earmarks of a neurosis which was definitely originated by an extreme fear. During the first interview, it was explained to him that he was completely recovered organically, but that his present symptoms were due to an underlying neurosis. He also was shown that while walking he did not bend his right knee. He was seen one week after the first interview, at which time he stated that he was sleeping better, that he was less nervous, and especially that he was walking better. At the third interview he told the examiner that without his permission he had removed his canvas belt, "as I don't feel the need for it anymore." He also had abstained from using the cane. At the fourth interview he was further improved and asked when the examiner would permit him to return to work. After the fifth interview he was released for work.

THIS PAPER was written primarily to give more emphasis to the definite need of referring patients at an early date to a specialist in mental and nervous diseases for diagnosis, as well as treatment. It should also be emphasized that many times a neurosis is developed, not directly as the result of the injury, but because of the thoughtless statements made by people surrounding the patient. It is important to remember that many people have been employed, especially during time of war, without proper physical and mental examination, and in whom a mental illness was not apparent when first employed, but became apparent at the time of an injury. The greatest problem still remains with people who are malingering. I am unable at this time to report conclusively on my experiences with the sodium amytal interviews. It has been known for a long while that a patient who is suffering from delusions or hallucinations will present the same delusions and hallucinations under the influence of sodium amytal. With this rationale in mind, I have found in a number of cases that if a patient is suspected to be a malingerer, under the influence of sodium amytal he will exaggerate his complaints and the movements of his body more than on a conscious level. A neurotic, however, will become calm and lose most of his neurotic complaints, and many times a sodium amytal interview is beneficial to the point of removing the underlying cause of the neurosis. Furthermore, I would like to emphasize that a thorough physical and neurological examination will give some clues, especially with the aid of an E.E.G. for head injuries, and an electromyogram for back injuries, as to the presence of a neurological condition.

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Surgical Conditions of the Knee

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THE KNEE is a complex articulation: it contains intra-articular fibrocartilages and ligaments; the articular cavity is large; it is lined by the most extensive investment of synovial membrane and hyaline plates. Besides the vast coat of cartilage which covers the articular ends of the femur and the tibia, the joint cavity receives additional lining from the hyalin facet of the largest sesamoid bone in the body, the patella. The fabella, a small sesamoid bone often found in the lateral head of the gastrocnemius, also offers the articular cavity of the knee a hyaline surface.

The knee is a weight-bearing joint. It links the longest two bones in the skeleton—two long levers which can be pried and twisted. The joint gains no strength from the adaptive configuration of the bones it unites. Unlike the ankle, the knee has no side buttresses such as the malleoli; it has no protective hood like the shoulder; it has no ball-and-socket arrangement as is present in the hip; no massive muscles swathe or support it. The knee is a superficial articulation; it is weak and vulnerable; it is heir to a multitude of derangements.

Surgery is indicated for a multitude of lesions. As in other joints, dependent drainage is established in pyogenic arthritis and tuberculosis is treated by fusion; arthrodesis may also be advised for flail joints, for Charcot knee and for extremely painful old burnt out arthritis. Specifically, the knee joint is operated upon for lesions of the semilunar cartilages, for synovial outpouchings, for osteochondritis dissecans and osteocartilaginous loose bodies, for chondromalacia of the patella and for certain patellar fractures, for depressed plateau fractures, for pigmented villonodular synovitis and for subsynovial tumors, fatty or otherwise.

Meniscal Lesions

THE MEDIAL meniscus of the knee forms the segment of a larger circle; it is more oval than circular; its horns diverge, giving the cartilage an elongated span. The lateral meniscus is more circular; its anteroposterior diameter is small and its horns converge.

All along its circumferential border, the medial semilunar cartilage is firmly connected to the tibial collateral ligament; in addition, it receives attachment from the semimembranosus tendon. The fibular collateral ligament of the knee bypasses the lateral semilunar cartilage; the popliteus muscle, which occupies a position analogous to that of the semimembranosus, rubs but does not connect with the circumferential border of the lateral meniscus. A fold of synovial membrane intervenes between the meniscus and the popliteus tendon; from this plica a diverticulum extends down along the popliteus tendon and an isthmus at times connects this out-pouching with the proximal tibiofibular joint. In back of the knee, the lateral semilunar cartilage sends a strong fibrous slip to the posterior cruciate ligament.

The articular facet of the tibia, which the medial meniscus deepens, is definitely concave; it is cupped from before backward, and the semilunar cartilage rises from the central depression as a hedge. The outer articular facet of the tibia, which the lateral meniscus rims, is only slightly concave from side to side and is convex from before backward; its central unpadded area is small and lies flush with the superior surface of the lateral meniscus.

To compensate for the obliquity of the shaft above, the medial condyle of the femur tilts inward and is more prominent posteriorly: it has to be "screwed home" in the terminal phase of extension of the knee. This internal rotation of the femur or, what amounts to the same, external rotation of the tibia, is a common accompaniment not only of walking and standing but also of running, jumping, of throwing a ball or hitting it. External rotation of the femur, which would cause the lateral condyle to bear upon the meniscus underneath, is a comparatively uncommon movement.

Because it has less room to move, because it is more firmly connected and cannot move, because it hedges itself in the pathway of the grinding medial condyle of the femur and may be swept or stripped by it, and because this very internal rotation of the femur is a common activity, the medial semilunar cartilage is torn far more frequently than the lateral. Because it is confined and compact, and has more room to move, because it is unattached along its periphery and can yield to push or pull, because it lies flush with the uncovered portion of the superior articular surface of the tibia, and because it is not in the pathway of a more common twist of the femur, the lateral meniscus of the knee seldom tears. When the posterior cruciate to which it is attached in the back is avulsed, the lateral meniscus loosens its mooring in the rear and shifts forward into the knee. The attachment of the lateral semilunar cartilage by way of the ligament of Humphrey or Wrisberg to the posterior cruciate is reminiscent of early mammals, in which this cartilage is connected to the femur rather than the tibia and moves with the former. In man, the lateral meniscus has a greater tendency to atavism: it remains

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discoid, the most important feature of which is not the fact that the cartilage constitutes a solid plaque or an all-around circle, but that it is more firmly attached to the femur posteriorly and lifts from the tibia with a "clunk" when the posterior cruciate is made taut as in extension of the knee. Finally, the lateral meniscus is prone to cyst development along its circumferential margin, and the friction caused by the popliteus tendon may have something to do with these ganglia-like tumors.

Synovial Outpouchings

IN THE BACK of the knee a septum divides the articular cavity into two compartments. The so-called Baker's cyst or the gastrocnemio-semimembranosus bursa communicates with the inner and the diverticulum along the popliteus muscle connects with the outer compartment of the posterior knee joint. Both outpouchings partake in the changes to which the synovial lining of the main joint is heir: they contain villi, adhesions, osteocartilaginous bodies, and gain in capacity with the rest of the joint cavity as a result of repeated hydrarthrosis. Their dependent position, their twisted course around tendons and muscles, and the narrow neck which joins them with the main articular cavity, subject these diverticula to localized irritations. They become filled and distended with thick glairy exudate which will not empty into the main joint and causes them to become distended and large and interfere with the flexion of the knee. The synovial lining of the popliteal outpouchings of the knee may form villi and osteocartilaginous bodies. Loose bodies formed in the main joint may gravitate into the popliteal diverticulum, usually into the one along the popliteus tendon, which connects with the joint through a wider neck. The isthmus between the gastrocnemio-semimembranosus bursa and the inner compartment of the posterior knee is often too narrow to permit the passage of anything but transudate and air. One must therefore expect greater stagnation and enlargment of the gastrocnemio-semimembranosus outpouching. Osteocartilaginous bodies find their way more commonly into the diverticulum along the popliteus and through it into the proximal tibiofibular articulation.

Osteocartilaginous Bodies

THE SYNOVIAL membrane which arises from the same primitive connective tissue but remains comparatively undifferentiated — hence reactive and reproductive—can produce both cartilage and bone by metaplasia. Named erroneously a membrane, the synovial investment of the joint consists of a flattened connective-tissue surface and an underlying vascular, adipose areolar or fibrous layer with no basement septum intervening. Most of the reactive and reproductive changes of the synovial membrane occur underneath its surface, within the outer vascular stratum. Here plaques of cartilage or bone may form and remain intramural; they may push their way into the joint and hang pedunculated or break loose into the articular cavity. Articular ends of bones themselves may give rise to osteocartilaginous loose bodies. In osteoarthritis, marginal or epiarticular osteophytes may become detached; pieces of bone covered with cartilage on one side may break loose into the joint following acute trauma; the articular end of a bone may become infarcted in part or in its entirety, due to blockage of the blood supply. Dead bone and cartilage crumble into pieces which float loose in the articular cavity. It is always advisable to examine the opposite joint, as the condition is at times bilateral. Occasionally one will find several members of the same family afflicted with a tendency toward formation of osteocartilaginous bodies in one or both knees.

Pigmented Villonodular Synovitis

THE CONDITION which was formerly called xanthoma, giant-cell xanthoma, or benign synovioma partakes of some of the features of inflammation and of tumors. Tissue proliferation occurring in the vascular stratum of the synovial membrane may extend outward toward the capsule or inward in the direction of the joint cavity. In such joints as the radiocarpal or the posterior talocalcaneal, where the articular space is snug and will not permit any encroachment, proliferated tissue will grow outward, toward and through the capsule as a solitary tumor. In the knee, the condition manifests itself in the form of localized or diffuse thickenings of the outer zone of the synovial membrane which push ahead the surface linings and hang into the articular cavity as villi and thick-stalked nodules. As in the villous phase of rheumatoid arthritis, the secreting surface of the synovial membrane is expanded, there is excessive fluid, and the joint cavity enlarges. As a result of the crowding of the villi together, some of them undergo intermittent pressure necrosis, and repeated aspirations will show the fluid to be serosanguineous. Reabsorbed blood gives the synovial surfaces a dark pigmented hue, and bruised villi may become matted in a mesh of friable fibrinous adhesions. In contrast to rheumatoid arthritis, however, granulations do not seem to break through the synovial surface and erode the articular plates: there is not true pannus. Surface-to-surface adhesions impeding the movements of the joint like the knee, with a large articular cavity, are made by (a) the repeated aspiration of serosanguineous fluid in the absence of a history of hemophilia; (b) arthrograms which reveal an enlarged articular cavity containing fluid. The shadow cast by the joint cavity presents a smooth contour and gives a bubbly flocculent effect due to the filling defects produced by villi and nodules.

Pigmented villonodular synovitis may be bilateral. It may be familial: one sister and two brothers were afflicted by it; they all had hydrops of both knees, and one brother had in addition swollen wrists.

Tumors

LIPOMATA are perhaps the most common tumors which encroach upon the articular cavity of the knee. Fat is found normally around joints which permit free movement. Fat facilitates motion. Articular fat is laid diffusely or in compact lumps. When several discrete rounded tendons hug the joint capsule or play upon the articular ends of bones, adipose tissue fills their interstices diffusely; where the tendons are conjoined into flat aponeurotic cords and have to use the skeletal prominences as fulcra, one or more pads of fat intervene between them and the synovial sac, or between the latter and the underlying bone. To put the same principle on a functional basis, loose fat is found on the side of the joint toward which greater range of movement is allowed; compact pads cushion the side of the joint in the direction of which movement is limited. Lipomata arise more commonly from confined cushions of adipose tissue than from loose areolar fat; they occur, therefore, on the side of the joint toward which movement is limited.

In the knee, organized articular fat pads are found on its extensor aspect. The prefemoral fat pad saddles the distal articular end of the thigh bone and supports the posterior synovial lining of the suprapatellar pouch; the infrapatellar fat pad fills the space between the extensor tendon in front and the synovial lining of the anterior chamber of the knee. Hypertrophy of the infrapatellar fat pad is a well recognized clinical entity, but it is not generally recognized that the more sluggish prefemoral cushion is a more common source of true lipomata. Both the prefemoral and infrapatellar fat pads may contain calcific deposits simulating osteocartilaginous bodies. Filling defects of the articular cavity may also be caused by hemangioma, synovial ganglia, polyps, fibroma and enchondroma. Synovial cysts and ganglia occur more often near the circumferential border of the menisci; synovial fibroma and chondroma cast denser shadows than lipomata. Synovioma is an extremely rare tumor.

Surgery may become expedient for depressed fractures of the tibial plateau, usually the outer, and for some patellar fractures. Fractures of the patella, caused by muscular pull, usually require surgery as the parapatellar capsule is torn and the quadriceps function is nullified. When the patella is broken into two large pieces, the fragments may be approximated and held together by wire or screw; in comminuted fractures, patellectomy is preferred. Patellectomy is also indicated in severe chondromalacia and mushrooming of the patella as occurs in osteoarthritis in the aged; in the young, patelloplasty in the form of trimming and narrowing the bone to a nubbin assures more efficient quadriceps function. When the suprapatellar pouch is filled with adhesions, quadriceps-plasty of the Thompson type will benefit. In arthritis, severing the adhesions surgically is preferred to manipulations, and in flexion contractures, with incongruous interlocked articular surfaces, supracondylar osteotomy assures of more lasting correction than posterior capsulotomy.

(30 North Michigan Ave.)

The April Meetings

THE AMERICAN ASSOCIATION OF RAILWAY SURGEONS will hold its Sixty-Second Annual Meeting at the Drake Hotel, in Chicago, April 4-6.

THE AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS has its Thirty-Fifth Annual Meeting scheduled for the week of April 24-29, 1950, at Hotel Sherman, Chicago. The participating allied organizations, meeting at the same time and place, are AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS, April 22-25; AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, April 25-27; AMERICAN ASSOCIATION OF INDUSTRIAL DENTISTS, April 25-27; AMERICAN ASSOCIATION OF INDUSTRIAL NURSES, April 23-29. All sessions are to be at the Sherman. More than 100 papers will be read during the eight-day Conference. Among the matters to be discussed are the toxic effects of materials used in industry, accident hazards, industrial medical aspects of the radioactive isotopes, treatment of injuries, x-ray interpretation of industrial cases, the use of antibiotic or "miracle" drugs, the effects of the newer treatments for arthritis, the value of an industrial eye program, back injuries, trends in vacation policies, periodic health examination of executives, and the importance of human relations with the industrial worker. Preliminary programs may be obtained from DR. E. C. HOLMBLAD, A.A.I.P.&S. Managing Director, 28 East Jackson Boulevard, Chicago 4.

ASSOCIATION NEWS

CONTRIBUTIONS are continuing to be received for the C. O. SAPPINGTON MEMORIAL FUND. These may be made directly to the AMERICAN FOUNDATION OF OCCUPATIONAL HEALTH, or to the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, stipulating that they are to be used for the C. O. SAPPINGTON MEMORIAL SCHOLARSHIP.

RECENT, and welcome, visitors to the Association offices include DR. ARTHUR E. SULEK, of Cedar Rapids, Iowa, DR. CLARENCE D. SELBY, Detroit and Ann Arbor, Michigan, and DR. FENN E. POOLE, of Glendale, California.

GREETINGS and good wishes to this Association have been received by DR. FREDERICK W. SLOBE, Secretary, from the Association of Industrial Medical Officers of Ireland, through its Hon. Secretary and Treasurer, DR. JOHN F. EUSTACE, 52 Merrion Road, Dublin.

DURING the past few months some interesting inquiries have come to the Association offices for adequately trained industrial physicians to fill available positions. These offer opportunities to younger men with little industrial experience, and to men of considerable and comprehensive industrial medical background, capable of handling the medical directorships of medium- and large-sized industries. The increasing demand for industrial physicians and surgeons indicated by these requests confirms the necessity for doing everything we possibly can as an Association to set up adequte training and educational facilities in this specialty field. If you know of any physicians who are interested in positions now open, or who will be interested in gaining additional training so as to be available for opportunities of this kind, please advise the Managing Director of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, 28 East Jackson Boulevard, Chicago 4.

ON TUESDAY evening, January 17, the Milwaukee Section of the Wisconsin State Nurses' Association held a meeting at the Milwaukee Athletic Club attended by more than 180 persons. Industrial nurses predominated, and there were many industrial physicians present, as well as numerous representatives of management—from vice-presidents to personnel directors. The industrial nurses' arrangements for the meeting included flowers, attractive tables, fellowship gatherings, and a pre-dinner cocktail hour. It was the privilege of the A.A.I.P.&S. Managing Director to address this gathering on the subject, "Evaluation of the Industrial Nurse and Some Experiences in the Industrial Nursing Field." At the speakers' table were: MISS MARGARET M. WIESNER, R.N., Chairman, Industrial Nurses' Section, Milwaukee District, Wisconsin Nurses' Association; MRS. WALTER L. BRAUER, President, Milwaukee District, Wisconsin State Nurses' Association; MISS FABIAN TAYLOR, Vice-Chairman; MARGARET MCKALE, Secretary; MRS. BETTY WENDT, Acting Program Chairman; HARRIET HOPPEN, Arrangements Committee Chairman; DR. EDWARD C. HOLMBLAD; and the REV. MCKINNON, Director of the Labor College of Marquette University, who gave the invocation.

Fellowship Report

REPORT OF JOHN HOWARD JOHNSTON, Fellow in Industrial Medicine, School of Medicine, University of Pittsburgh, for three-month period, July to September, 1949: "During the summer months of the Fellowship in Industrial Medicine, July to September, I observed and actively participated in the medical program at Westinghouse Electric Corporation. I began my duties at the Industrial Hygiene Laboratory where lead urine determinations, appropriately enough for an embryo industrial physician, were my first source of difficulty and achievement. Later, the determination of inorganic and organic urinary sulphates, beryllium and antimony, were but a few of the analytical procedures unveiled. Ample opportunity was given to observe the employees in their industrial environment. Environmental conditions were studied in regard to lighting, air pollution, dust hazards, noise, and chemical contamination and toxicity. Sources of industrial eye hazards were pointed out. The uses of various safety devices, ventilating systems, and engineering methods were explained and demonstrated. Examinations of air samples for vapors and fumes were carried out. The Greenberg-Smith impinger, the Midget impinger, and electrostatic precipitators were used in the sampling of dusts. In conjunction with the air sampling, the gas chamber was brought into play for calibrating the explosimeter and, incidentally, the olfactory nerve. During this phase of the fellowship, a field trip was made to the Westinghouse porcelain plant at Derry, Pennsylvania. Of particular interest here is a potential dust hazard. This plant is exceptionally well ventilated, with numerous ducts and vacuums in strategic points. It was noted that in dusty operations mechanical means are used to handle the raw materials. As the next logical procedure in a course devised to instruct a physician in an industrial plant, the duties of pre-placement examinations were assumed, as I now was able more intelligently to examine the applicants for employment in regard to the specifications of the job. The pre-placement examination is not for the purpose of rejecting applicants with physical defects, but rather to match their capabilities to the positions. One with a physical defect is employable so long as the type of work assigned will not aggravate or affect his condition in any way. Along with pre-placement examinations, periodic physical examinations were done on those employees engaged in hazardous occupations. This particular examination is devised to protect the employee from occupational diseases. In some cases, the need for change of occupation is discovered in this way. General dispensary work was done at a later time. Industrial injuries and diseases were treated. Advice was given on non-occupational conditions until the private physician could be consulted. An opportunity was afforded me to participate in conferences between labor and management on matters of health and safety. Industrial accidents and job requirements were reviewed, compensation claims were analyzed, and compensation laws clarified. These conferences gave me a broad concept of present-day industrial relations as they relate to the medical field. In conclusion, I feel the training afforded me during these

three months in this excellent medical set-up will be of invaluable aid and guidance in my future endeavors in the expanding field of industrial medicine.

—JOHN HOWARD JOHNSTON,
Fellow in Industrial Medicine,
School of Medicine,
University of Pittsburgh.

DR. CARL OLSON'S Committee on Workmen's Compensation and Insurance is undertaking the compiling of information on subjects relating to workmen's compensation, particularly as to the features concerning which the practice is different in the various States. The differences in connection with aggravations of pre-existing disabilities and second-injury funds are especially important. Through the cooperation of DR. THOMAS W. NALE, Medical Director, and MR. C. R. OVIATT and MR. T. A. MOORE, of the Law Department, Union Carbide and Carbon Corporation, the Committee submits the following memorandum on the statutory provisions of all the States relating to these matters:

Workmen's Compensation Acts —A Review of Statutory Provisions Relating to Aggravation of Pre-existing Conditions and Second Injuries—

Prepared by
C. R. OVIATT and T. A. MOORE,
Law Department, Union Carbide and Carbon Corporation,
New York

THE PHASES of the various Workmen's Compensation Acts named in the above title are not entirely covered by precise language in the statutes, especially in regard to aggravation of pre-existing conditions. This particular phase is dealt with in the decisions of the various governing bodies in the interpretation of sections having to do with coverage of injuries and occupational diseases. Therefore, it is advisable to consider these sections of the Acts.

Second injuries are more specifically dealt with in precise enactments which consider the effect of previous disabilities.

For a more detailed review of both these phases, resort to the Acts of the various States is necessary. Rather than to quote them in their entirety, the statutory sections are digested in summary form:

Alabama

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injury "caused by an accident," as defined, arising out of and in the course of employment, unless caused by employee's wilful misconduct, intention to injure himself or another, intoxication, wilful failure or refusal to use safety appliance provided or to perform a statutory duty, any other wilful violation of law or wilful breach of a known rule or regulation of employers. Accident means unexpected or unforeseen event, happening suddenly and producting at time injury to physical structure of body. Time and place when and where accident causing injury must occur defined.

2. *Occupational Diseases:* Excluded, except such cases as result proximately from accident.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If an employee with a pre-existing injury suffers a subsequent permanent injury, compensation is payable only for the degree of disability that would have resulted from the later accident if the earlier injury had not existed, unless the earlier injury was suffered in the same employment or the combined injuries consist of loss of both eyes, legs or arms, in which event compensation is as specifically provided.

Arizona

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Injuries or death by accident arising out of and in the course of employment, unless purposely self-inflicted. Not to include disease except as it shall result from injury.

2. *Occupational Diseases:* Excluded, except such cases as result from injury by accident. However, these diseases are covered in the Occupational Disease Disability Law which allows compensation for total disablement or death from any one of 36 specific occupational diseases, fairly traceable to the occupation as a cause, where disability results within 120 days, or death occurs within one year, from last day of work for employer against whom compensation is claimed.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of previous permanent disability, the percentage of disability for subsequent injury is to be determined by computing percentage of entire disability and deducting therefrom the percentage of previous disability as it existed at the time of subsequent injury. When an employee who has previously lost by separation, or lost the use of, one hand, one arm, one foot, or one eye, becomes permanently and totally disabled from the loss by separation, or loss of use, of the corresponding member organ, he shall receive compensation for partial disability and, after termination of the period of such compensation, he shall be paid from the Special Fund the remainder of the compensation that would be due for permanent total disability.

Arkansas

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental injuries arising out of and in the course of employment, including occupational infections so arising unless solely caused by intoxication or by wilful intention to injure self or another.

2. *Occupational Diseases:* Disability or death from any of the diseases listed in 15 groups in a schedule, which only are deemed to be "occupational diseases," is to be treated and compensated as if caused by injury, provided that the disease was due to the nature of the employment and that disablement or death occurs within three years after last injurious exposure in case of silicosis or asbestosis, or within one year thereafter in case of other disease. Further it is provided that where an occupational disease is aggravated by or itself

aggravates any other disease or infirmity not itself compensable, compensation shall be reduced; that the last employer under whom the employee was injuriously exposed shall alone be liable for the compensation.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of successive permanent injuries in same employment, compensation is payable for the healing period and permanent disability by extending the period, but not increasing the amount, of weekly payments. Where previous and subsequent injuries shall result in permanent total disability, compensation is payable for such condition. In case of permanent injury following another previously sustained in different employment, if such injury is not classified in the specific schedule, compensation shall be only for the degree of disability that would have resulted from the subsequent injury alone and if scheduled, for healing period and disability caused only by subsequent injury.

California

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Any injury arising out of and in course of employment and proximately caused thereby, including injury to artificial members, and death if proximately caused by the injury, unless intentionally self-inflicted or due to intoxication. If injury is due to serious and wilful misconduct, compensation is to be reduced one-half, except in certain cases. "Injury" includes a disease arising out of employment; but in case of aggravation of pre-existing disease only such proportion of disability due to aggravation as may reasonably be attributed to the injury is to be compensated for. And no compensation is payable for death or disability due to unreasonable refusal to submit to medical or surgical treatment.

2. *Occupational Diseases:* Any disease arising out of the employment is covered. But in case of aggravation of pre-existing disease, compensation is payable only for so much of disability due to aggravation as may reasonably be attributed to injury arising out of employment.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Previous disability is not to preclude compensation for later injury; but in determining compensation, average earnings are to be fixed as such sum as will reasonably represent earning capacity at time of later injury. Compensation for later injury not to exceed amount allowed for such injury when considered by itself and not in conjunction with previous disability. If an employee who has previously lost, or lost the use of, a hand, an arm, a foot, a leg, or an eye, receives an additional permanent partial disability so that the combination of both disabilities results in a permanent disability equal to 70% or more of total, he shall be paid, in addition to compensation for the last injury, compensation from the State Insurance Fund for the combined injury in the manner and amounts as the Commission shall prescribe.

Colorado

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries proximately caused by accident arising out of and in the course of employment, unless intentionally self-inflicted.

2. *Occupational Diseases:* Excluded in Compensation Law, except such cases as are proximately caused by accident. Covered by separate enactment known as "Colorado Occupational Disease Disability Act" which allows compensation for disability or death resulting from any of 22 listed occupational diseases, fairly traceable to employment as a proximate cause, unless caused by wilful misconduct or by wilful self-exposure as defined.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Previous disability is not to preclude for later injury, but in determining such compensation, average earnings to be such sum as will reasonably represent earning capacity at time of later injury. When an employee who has previously lost, or lost the total use of, one hand, one arm, one foot, one leg, or the vision of one eye and, in a compensable accident he suffers a second injury of the above described class, the loss of the second member shall prima facie constitute permanent total disability, but the employer shall be liable for compensation for the subsequent injury, and the remaining payments until the death of the employee shall be made out of the "Subsequent Injury Fund" to which each employer or carrier shall contribute $500 in each no-dependency death case.

Connecticut

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental personal injuries and occupational diseases as defined arising out of and in the course of employment, unless due to wilful and serious misconduct or intoxication. Although "injury" was originally limited to an injury which was definitely located as to time when and place where accident occurred, subsequent amendment enlarged the meaning of "injury" to include an injury to an employee which is causally connected with his employment and is the direct result of repetitive trauma or repetitive acts incident to such employment. Not compensable are deaths or disabilities due to acceleration or aggravation by accidental injuries of certain vice diseases, and in case of aggravation of other pre-existing diseases only the proportion of the disability or death reasonably attributable to the aggravation is compensable.

2. *Occupational Diseases:* The Act applies to "occupational disease" meaning a disease particular to the occupation and due to causes in excess of the ordinary hazards of employment as such. An injury traceable to the employment only through weakened resistance or lowered vitality is excluded.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* An employee who has previously by accidental injury, disease or from congenital causes, lost, or lost the use of, one hand, one arm, one foot, one leg, or one eye and becomes permanently and totally incapacitated through the loss, or loss of use, of another such member or organ, shall be paid compensation for the latter injury only, by the employer, and shall receive, after the completion of such payments, the balance due for permanent total disability from the Second Injury Fund, subject to the maximum and minimum limits prescribed for total disability. If the employee establishes an earning capacity, the payments shall be 50% of the difference between the latter and former average earnings. Employee who has lost a member or a part of a member or use thereof, or reduction of vision in one eye to 1/10 or less of normal vision with glasses, is not

to receive compensation for later injury in excess of that allowed for such injury considered by itself and not in conjunction with previous injury. In case of aggravation of a pre-existing disease, compensation is payable only for the portion of the disability or death reasonably attributable to the injury upon which claim is based.

Delaware

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries of violence to physical structure of body, by accident arising out of and in course of employment, and such disease or infection as naturally results therefrom, unless due to intoxication, recklessness, wilful failure to use safety appliances or to perform statutory duty, or intent to injure one's self or another.

2. *Occupational Diseases:* Compensation is payable for death or disability resulting from any of 16 "compensable occupational diseases" listed in a schedule provided that disability commences within five months after termination of exposure and that there has been no "wilful self-exposure" as defined. Provision is made for reduced compensation where disability is due in part to a compensable occuptional disease and in part to a pre-existing disease or infirmity. Notice of and claim for compensation for occupational disease must be given and made respectively within five months and one year after latest exposure. Also compensable are such diseases or infections as naturally result directly from accidents of violence when reasonably treated.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Whenever a subsequent permanent injury occurs to an employee who has previously sustained a permanent injury, from any cause, the employer shall be required to pay compensation for the subsequent injury only, and if the combination of both permanent injuries results in total disability as defined, the employee shall be paid compensation from the Second Injury Fund during continuance of such disability. Where disability is due in part to occupational disease and in part to pre-existing disease or infirmity, compensation is payable only for that portion of disability attributable to occupational disease.

Florida

AGGRAVATION OF PRE-EXISTING CONDITIONS:

Coverage of Injuries: Personal injuries by accident arising out of and in course of employment, and such disease or infection as naturally or unavoidably results therefrom, unless caused primarily by intoxication, wilful intention to injure self or another or by refusal to use safety appliance or to observe a safety rule of which employee had knowledge, and approved by Commission or required by statute. "Accident" defined to mean only unexpected or unusual event, happening suddenly and to exclude a mental or nervous injury due to fright or excitement, or disability or death due to acceleration or aggravation of certain vice diseases. In case of acceleration or aggravation of other pre-existing diseases compensation is reduced.

2. *Occupational Diseases:* Disablement or death resulting from an occupational disease as defined shall be treated as an accidental injury, where employer and employee are subject to Act. Disease must result from "nature of employment" and must have been contracted while so employed. Defines "nature of employment" to mean that a particular hazard of such disease is attached to the occupation which distinguishes it from the usual run of occupations. Death must result within 350 weeks after such last exposure and must follow continuous disability from such disease commencing within the period above limited.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of permanent injury following another previously sustained in same employment, compensation is payable for both, by extending the period but not increasing the weekly amount of compensation, maximum 500 weeks. When successive injuries in same employment result in permanent total disability payments made for previous injury are to be deducted from total disability award. In case of permanent injury following another sustained in different employments compensation is payable only for the degree of injury that would have resulted from subsequent accident alone.

Georgia

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of the employment, unless due to wilful misconduct (including intention to injure self or another, intoxication and wilful failure to obey a known and approved safety regulation of employer or to perform a statutory duty). Not to include a disease unless it results naturally and unavoidably from accident, nor injuries caused by wilful act of a third person directed against employee for reasons personal to employee. No compensation for death or disability caused by unreasonable refusal to submit to proper surgical treatment.

2. *Occupational Diseases:* Disablement or death resulting from exposure to any of 23 occupational diseases enumerated shall be treated as the happening of an injury by accident and compensation paid as provided by the Act. Disablement is defined to mean actual incapacity to perform work in the last occupation in which the employee was injuriously exposed or any work for remuneration. The provisions apply only to diseases specifically enumerated and only then when such are due to causes and conditions which are characteristic of and peculiar to a particular trade or employment and when such diseases arise out of and in the course of such employment, and only where the last exposure occurred within the state and subsequent to the effective date of this statute.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Employee suffering successive injuries in same employment is entitled to compensation for that injury which will cover longest period and largest amount, but not for both injuries. If successive injuries produce total permanent disability, payments for previous disability are to be credited on award for total permanent disability.

Idaho

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries caused by accident arising out of and in the course of employment, unless due to wilful intention to injure self or another. "Accident" defined to mean unexpected, undesigned and unlooked for mishap or untoward event, happening suddenly, at a definite time and place. "Injury" means only an injury by

accident of violence to the physical structure of the body, including only such "non-occupational" disease as results directly from such an injury. "Injury by accident" includes an injury caused by the wilful act of a third person directed against an employee because of his employment.

2. *Occupational Diseases:* Disability or death from any of the diseases listed in 11 groups in a schedule which only are to be deemed "occupational diseases" if due to the nature of specified occupations or processes and contracted therein under specified conditions, is to be treated and compensated as injury by accident. Compensation shall be reduced where an occupational disease aggravates or accelerates or is aggravated or accelerated by other disease or infirmity not itself compensable.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If the degree or duration of disability resulting from an accident is increased or prolonged because of a pre-existing injury or infirmity, employer shall be liable only for the additional disability resulting from such accident. Any compensation previously paid for permanent disability to any member or part of the body shall be deducted from compensation provided for permanent disability to the same member or part of body caused by a change in his physical condition or by a subsequent accident. Additional compensation that would be due for permanent total disability is to be paid out of Special Indemnity Fund.

Illinois

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental injuries (with proved objective symptoms) arising out of and in course of employment.

2. *Occupational Diseases:* Any occupational diseases arising out of and in the course of employment, provided disablement, as defined, occurs within one year after the last day of the last exposure to the hazards of the diseases.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of loss, or loss of use, of hand, arm, foot, leg or eye, followed by loss of another such member, or loss of use thereof, in another accident, employer shall be liable for second injury only; but additional compensation, to make up amount payable for permanent total disability, is to be paid out of special fund derived from payments in case of death without dependents, etc. Loss or loss of use of any member in previous accident is to be deducted from award for subsequent injury. In case of previous disability for which employee was drawing compensation under Act, compensation for subsequent injury is to be apportioned according to proportion of incapacity caused by respective injuries.

Indiana

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in course of employment, unless due to wilful misconduct (including intention to injure self, commission of a felony or misdemeanor, intoxication and wilful failure or refusal to use safety appliance, to obey a reasonable and posed rule or perform statutory duty). Not to include disease except as it results from such injury.

2. *Occupational Diseases:* Any occupational diseases arising out of and in the course of employment as defined unless intentionally self-inflicted or due to intoxication, failure to use safety appliance, etc., provided disablement, as defined, occurs within one year after the day of the last exposure to the hazards of the disease, provided that the last exposure to the hazards of the disease occurred on or after the day of employer's election to come under the Act.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If previous permanent injury sufferd in another employment or from other cause than employment in which subsequent injury occurred, compensation for second permanent injury same as if first had not occurred. In case of successive injuries in same employment, employee is entitled to compensation for that injury which will cover longest period and largest amount, but not for both injuries. If permanent injury followed by another, also permanent, compensation allowed for both, by extending period, but not increasing weekly rate of payments. If successive injuries produce total permanent disability, payments for previous disability to be credited on award for total disability. Where subsequent injury results only in aggravation of previous injury, compensation is payable only for that part of disability resulting from subsequent injury.

Iowa

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries arising out of and in the course of employment, unless due to wilful intention to injure self or another, proximately to intoxication or to assault by third party. Not to include disease except as it results from such an injury.

2. *Occupational Diseases:* Disability or death from any one of 16 occupational diseases listed in a schedule, and as defined, is compensable. Disablement or death must result within one year after the last injurious exposure, or, in case of death, if it follows continuous disability commencing within the period limited within seven years after such exposure.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Where employee was previously disabled and drawing compensation under Act, compensation for each subsequent injury is to be apportioned according to proportion of incapacity from the respective injuries.

Kansas

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment unless proved to be due to injured employee's deliberate intention or wilful failure to use guard or solely to his intoxication. Injuries on way to or from work, not due to employer's negligence, expressly excluded.

2. *Occupational Diseases:* Excluded, except such cases as result from injury by accident.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If employee has suffered previous disability, compensation for a later injury is to be based on earning capacity at time of later injury. In case subsequent injury combined with previous disability causes permanent total disability, compensation shall be the difference between that allowed for prior injury and that allowed for total disability. Any workman who has

previously suffered a permanent disability as the result of a loss of, or loss of use of, a specific member of the body and later suffers a compensable injury to another specific member, the combination of which results in permanent total disability, shall receive the difference up to the compensation payable for permanent total disability from the Second Injury Fund.

Kentucky

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment unless wilfully self-inflicted or caused by wilful misconduct or intoxication.

2. *Occupational Diseases:* These are compensable as injury by accident where they are the natural and direct result of a traumatic injury by accident, silicosis, and injuries or death due to inhalation in mines of noxious gases or smoke or due to inhalation of any kind of gas. Compensation is payable only where disability or death occurs within three years after last injurious exposure or where death follows continuous disability for which timely claim was made within 10 years after last exposure.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If an employee who is permanently partially disabled receives a subsequent compensable injury resulting in additional permanent disability so that the degree of disability caused by the combined disabilities is greater than that which would have resulted from the subsequent injury alone, and such employee is entitled to receive compensation on the basis of the combined disabilities, the employer shall be liable only for the degree of disability which would have resulted in the absence of the prior disability.

Louisiana

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless due to (1) employee's wilful intention to injure self or another; (2) his intoxication; (3) deliberate failure to use a device or guard against accident provided by the employer; (4) deliberate breach of statutory regulations for safety. Accident means unexpected or unforeseen event, happening suddenly or violently and producing at the time objective symptoms of an injury. Injury includes only injury by violence to physical structure of body and such diseases and infections as naturally result therefrom.

2. *Occupational Diseases:* Excluded, except such cases as may naturally result from injuries by accident of violence to physical structure of body.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* No statutory provision.

Maine

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless caused by intention to injure self or another or due to intoxication without employer's knowledge.

2. *Occupational Diseases:* Disability or death resulting from any of 13 listed occupational diseases is compensable if last exposure occurred in the state and subsequent to the effective date of the Act.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Compensation for later injuries is not precluded by reason of previous disability; but in fixing compensation, average weekly wages are to be such sum as fairly represents earning capacity at the time of later injury.

Maryland

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental personal injuries arising out of and in the course of employment and such disease or infection as may naturally result therefrom (including frost bite and sunstroke resulting from weather conditions) unless self-inflicted or due to wilful misconduct or resulting solely from injured employee's intoxication.

2. *Occupational Diseases:* Disability or death from any of 39 listed diseases—which only are to be deemed "occupational diseases," when due to nature of employment in a process of occupation specified—is to be treated and compensated as an injury by accident, provided that disablement or death results within three years after the last injurious exposure in case of silicosis or asbestosis, or within one year thereafter in case of other diseases.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of further injury to employee previously disabled, future compensation is to be adjusted with regard to the combined effect of injuries and past receipt of compensation. Where disability is due partly to accidental injury or occupational disease and party to pre-existing disease or infirmity, compensation is payable only for proportion of disability reasonably attributable to the accidental injury or occupational disease.

Massachusetts

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries arising out of and in the course of employment, or out of ordinary street risks while engaged in employer's affairs and with his authorization, unless due to serious and wilful misconduct, including infectious or contagious diseases if hazard of their contraction is inherent in employment.

2. *Occupational Diseases:* Injuries to health are covered indefinitely. Special provisions, partly transitory, now condition right to, limit amount of, and specify insurer liable for compensation for "silicosis or other occupational dust disease" in the granite industry. Also now covered are infectious or contagious diseases under certain circumstances.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If an employee who has lost a hand or foot or sight of an eye, subsequently suffers a similar injury, one-half of the compensation payable for the resulting disability or death is to be paid by the insurer carrying the risk at the time of the subsequent injury, and the other half out of the special fund of the Treasury, accumulated from payments in case of death without dependents.

Michigan

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries arising out of and in the course of employment, unless due to intentional and wilful misconduct. "Personal injury" includes disease or disability due to causes

and conditions characteristic of and peculiar to employer's business and which arises out of and in the course of employment.

2. *Occupational Diseases:* The term "personal injury" includes a disability due to conditions characteristic of and peculiar to employer's business and which arises out of and in the course of employment. Disablement from such disease or condition is to be treated as the happening of a personal injury. Ordinary diseases of life to which the public is generally exposed outside of employment are not compensable.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If employee has, at the time of injury, permanent disability in the form of a loss of hand or arm or foot or leg or eye, and incurs further permanent disability in the form of the loss of any of such members, he is deemed totally and permanently disabled and entitled to compensation for such disability, after subtracting the amount of compensation received for both such losses. Special provision for reduction of compensation where disability or death due to some other non-compensable cause is aggravated or accelerated by an occupational disease or where disability or death due to an occupational disease is aggravated or accelerated by some other non-compensable cause.

Minnesota

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in course of employment, unless intentionally self-inflicted or proximately due to intoxication or to act of third person or fellow employee for personal reasons. "Accident" defined to mean an unexpected unforeseen event happening suddenly and violently and producing at the time an injury to the physical structure of the body.

2. *Occupational Diseases:* Act applies to occupational diseases arising out of and in the course of employment. "Disability" and "disablement" are defined. Prior enumeration of disease does not create presumption it is occupational. Diseases must be contracted in the employment within one year, and in the case of silicosis or asbestosis within three years, prior to disablement.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of injury which of itself would cause only permanent partial disability, but which, combined with a previous disability, causes permanent total disability, the employer is liable only for the disability attributable to the later injury alone. Where employee sustains concurrent injuries he is to receive compensation only for the injury producing longest period of disability, except in case of concurrent loss of more than one member.

Mississippi

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental injuries and accidental death, including injury to artificial members and injuries caused by wilful act of third person directed against employee because of his employment, arising out of and in the course of employment without regard to fault as to cause, excepting injury occasioned by intoxication of employee or by his wilful intention to injure or kill himself or another.

2. *Occupational Diseases:* No provision.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* When employee who has previously lost, or lost the use of, one hand, one arm, one foot, one leg or one eye, becomes permanently and totally incapacitated through loss of use of another member or organ, the employer shall be liable for the compensation payable only for such second injury.

Missouri

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, and such disease or infection as naturally results therefrom, unless intentionally self-inflicted. "Accident" defined to mean an unexpected or unforeseen event happening suddenly and violently and producing at the time objective symptoms of injury. "Injury" defined to mean only violence of physical structure of body and such disease or infection as naturally results therefrom.

2. *Occupational Diseases:* The term "injury" in this Act does not include occupational disease in any form, or any contagious or infectious disease contracted during the course of the employment; but Act not to be construed to abrogate any right under laws pertaining to occupational diseases, unless by specific joint election the employment is brought under this Act with respect to occupational disease.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Permanent disability following previous disability is to be compensated on basis of earnings at time of latest injury. If subsequent injury results in permanent partial disability, payment is to be made for resulting condition after deducting disability; if resulting condition be permanent total disability, employer is liable only for last injury considered alone, but if compensation is less than provided for permanent total disability, the difference is payable from Second Injury Fund. In case of concurrent temporary disabilities, compensation is payable only for longest and largest paying. In case of concurrent and consecutive permanent disabilities, compensation for each subsequent disability is not to begin until end of compensation period for prior disability.

Montana

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Injury arising out of and in the course of employment. "Injury" means only an injury resulting from fortuitous event, as distinguished from contraction of disease.

2. *Occupational Diseases:* Excluded, except such cases as may result from fortuitous event as distinguished from contraction of disease. By separate enactment, provision is made for payment out of public funds of $40 per month to any person totally disabled from silicosis who has been a resident of the state for 10 years or more and is not an inmate of a public institution.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If employee previously disabled sustains further injury, compensation is to be adjusted with regard to past compensation. Percentage of permanent disability caused by any accident is to be computed without reference to any previous ailment or injury.

Nebraska

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries of violence to physical structure of body by accident arising out of and in the course of employment including such disease or infection as naturally results therefrom, and including disablement from occupational disease, unless due to wilful negligence (as defined at length) or intoxication. Time and place when and where accident must occur limited. No compensation is payable for any aggravation of injury which is due to negligence or due to refusal of medical treatment furnished by the employer.

2. *Occupational Diseases:* Compensable injury includes disablement from occupational disease arising out of and in the course of employment, which was contracted in said employment, where disability commenced within two years subsequent to the date of termination of the employment, but not disability or death occurring while at work due to natural causes. In case of aggravation of a pre-existing occupational disease, employer is liable only for the degree of aggravation of pre-existing disease. "Occupational disease" means only a disease which is due to causes and conditions characteristic of and peculiar to a particular trade, occupation, process or employment, and not ordinary disease to which the general public is exposed.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If injury received would in itself cause only partial disability, but when combined with a previous disability, actually causes total disability, the employer is liable only for partial disability. In case of aggravation of a pre-existing occupational disease, employer is liable only for the degree of aggravation of pre-existing disease.

Nevada

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment unless due to the wilful intention of employee to injure himself or another or sustained while intoxicated. No compensation payable for death or disability in so far as caused or aggravated by unreasonable refusal to accept or follow competent medical treatment.

2. *Occupational Diseases:* Excluded, except such cases as caused by accident.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of previous permanent disability, the percentage of disability for subsequent injury is to be determined by computing percentage of entire disability and deducting therefrom the percentage of previous disability as it existed at the time of the subsequent injury.

New Hampshire

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental injury or death arising out of and in the course of employment, unless due in whole or in part to intoxication not known to employer or serious and wilful misconduct, but not including diseases or death from diseases unless the direct result of such accident except certain occupational diseases.

2. *Occupational Diseases:* Listed occupational diseases including diseases due to inhalation of poisonous gases or fumes and silicosis and other pulmonary dust diseases are covered. Diseases existing at commencement of employment and diseases where last injurious exposure occurred prior to effective date of Act, excluded.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Where an employee has at the time of injury a schedule injury and as a result of such injury incurs further permanent disability, the employer shall only be liable for the permanent partial disability caused by the subsequent injury; provided that in addition thereto and after cessation of payments by the employer such employee shall be paid from the Second Injury Fund the remainder of the compensation that would be due for permanent total disability.

New Jersey

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injury or death by accident arising out of and in the course of employment except when intentionally self-inflicted or when intoxication is the natural and proximate cause.

2. *Occupational Diseases:* Compensation is payable for personal injury or death by any "compensable occupational disease," which term includes all diseases arising out of and in the course of employment, which are due to causes and conditions characteristic of or peculiar to a trade, occupation, process or employment, or which diseases are due to exposure of any employee to a cause thereof arising out of and in the course of his employment. No compensation is payable where such injury or death is caused by wilful self-exposure.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Where employee is totally disabled as the result of a permanent injury following permanent partial disability previously sustained, he is to receive out of a special fund of the State Treasury, under certain conditions, additional compensation, in semi-monthly installments from the date when the final payment of compensation is due from employer for last injury sustained.

New Mexico

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless intentionally inflicted, or caused by intoxication. Injuries on way to or from work expressly excluded, unless approximately caused by employer's negligence.

2. *Occupational Diseases:* Excluded, except such cases as are caused by accident. However, "Occupational Disease Disablement Law" provides for payment of compensation for total disablement or death from any one of 30 occupational diseases specified, which can be fairly traced to the employment as a proximate cause where disability results within four months, or death occurs within one year, from the last day of work for employer against whom compensation is claimed.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of total disability resulting from loss of second member the first having been lost in prior accident, employer is liable only for partial disability in accordance with specific schedule.

New York

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental personal injuries arising out of and in course of employment, and such disease or infection as may naturally and unavoidably result therefrom, unless due to intent to injure self or another or solely to intoxication while on duty.

2. *Occupational Diseases:* Disability or death resulting from any of 28 occupational diseases listed in a schedule, or from "any and all occupational diseases" if due to the nature of an employment specified, and if contracted therein within 12 months previous to date of disablement, is to be treated and compensated as an accidental injury, subject to special conditions, including provisions for apportionment where the disease is contracted under several employers; requiring certain information to be given by employee to employer; requiring notice within 90 days after disablement; and establishing a presumption under certain circumstances that the disease was due to the nature of the employment.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Previous disability is not to preclude compensation for later injury nor for death resulting therefrom; but in determining compensation for later injury or death, average weekly wages to be such sum as reasonably represents earning capacity at time of later injury.

North Carolina

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless due to wilful intention to injure self or another or to intoxication, including diseases where they result naturally and unavoidably from accidents. "Accident" defined to exclude a series of events of a similar or like nature occurring regularly, continuously or at frequent intervals.

2. *Occupational Diseases:* Disablement or death resulting from any of 25 listed diseases and which only are deemed to be "occupational diseases" if contracted under specified conditions, is to be treated and compensated as an injury by accident. Employer under whom employee was last injuriously exposed to hazards of the disease (alone) liable for compensation.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Employee suffering from successive injuries is not entitled to compensation for both injuries at the same time. If permanent injury be followed by another, also permanent, compensation allowed for both, by extending period, but not increasing weekly rate of payments, maximum period 500 weeks. If loss of a member, following previous loss of another member, produces total permanent disability, employer's liability is for subsequent injury only. Permanent disability previously sustained in another employment not to be considered in arriving at degree of incapacity for which compensation is payable.

North Dakota

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Injuries arising in course of employment or disease which can be fairly traceable to the employment unless caused by voluntary intoxication or intent to injure self or another. Injuries to certain artificial members.

2. *Occupational Diseases:* The term "injury" includes any disease fairly traceable to the employment, as defined.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Compensation is payable in the case of injury to employee who has previously sustained injury in another employment or in the case of an aggravation of a previous injury as well.

Ohio

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries arising out of or in the course of employment, unless purposely self-inflicted. "Injury" construed to mean injury resulting from an accident.

2. *Occupational Diseases:* Compensation is payable from disability or death from any of 22 listed diseases and which are declared to be "occupational diseases," where due to the nature of specified processes, or from any other "occupational diseases," as defined in general terms, if contracted within 12 months previous to disablement. No compensation is payable for an occupational disease where the employee by certain acts or omissions, has misled the employer as to the employee's previous health history.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* When an employee of a self-insuring employer, after having lost a hand, arm, foot, leg, or eye, suffers the loss of another such member, employer is liable only for the disability sustained through the second injury; additional compensation, if any, to be paid by the Commission out of the surplus of the State Fund.

Oklahoma

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Accidental personal injuries, not resulting in death, arising out of and in course of employment, and such disease or infection as may naturally and unavoidably result therefrom, unless due to intent to injure self or another, or to failure to use safeguard provided pursuant to law or directly to intoxication while on duty.

2. *Occupational Diseases:* Excluded, except such cases as naturally and unavoidably result from accidental injuries. (But a disease of gradual contraction has been held to be an "accidental injury.")

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Previous disability does not preclude compensation for later injury; but in fixing compensation, average weekly wages to be sum reasonably representing earning capacity at time of later injury.

Oregon

AGGRAVATION OF PRE-EXISTING CONDITIONS:

Coverage of Injuries: Personal injuries by accident arising out of and in the course of employment, caused by violent or external means, unless caused by deliberate intention of the injured to produce the injury.

2. *Occupational Diseases:* Compensation is payable for any occupational disease which is peculiar to the industrial process, trade or occupation and which arises out of and in the scope of employment, and to which an employee is not ordinarily subjected or exposed other than during the period of actual employment, in the same amounts as provided for injuries by accident.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of further accident to workman already receiving compensation for temporary disability, compensation for such further accident is to be made with regard to combined effect of injuries and past receipt of compensation.

Pennsylvania

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident in course of employment, unless purposely self-inflicted or caused by employee's violation of law, or due to assault by a third party for personal motives. "Injury" means only violence to the physical structure of the body and such disease or infection as naturally results therefrom. "In the course of employment" defined.

2. *Occupational Diseases:* All such diseases or infections as naturally result from injuries by accident. Special Act entitled "The Pennsylvania Occupational Disease Act" specifically provides for compensation for disability or death resulting from any of the occupational diseases listed in a schedule of 12 groups, if contracted occupational diseases, provided disability results within three years or death occurs within three years after date of last employment, and is not caused by employee's violation of law.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* An employee who has incurred permanent partial disability, from accident or otherwise, through the loss, or loss of use, of a hand, arm, foot, leg or eye and incurs total disability through a subsequent injury causing loss or loss of use of another such member, shall be entitled to compensation, payable by the Commonweath, after the cessation of payments for the subsequent injury, during the continuance of total disability and for the balance of the 500 week period.

Rhode Island

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless proved to be due to wilful intent to injure self or another or to intoxication while on duty.

2. *Occupational Diseases:* Disablement or death resulting from any of 31 occupational diseases listed, if due to the nature of the employment and (subject to exception) contracted within 24 months previous to disablement, is to be treated and compensated as an injury by accident. The terms "disability," "disablement," and "occupational disease," are defined. Also compensable are diseases resulting from injuries by accident.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Previous disability is not to preclude for later injury, but in determining compensation, average wages are to represent earning capacity at time of later injury, and without regard to wages earned prior to first injury.

South Carolina

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment (unless due to wilful intention to injure self or another or to intoxication), including disease where it results naturally and unavoidably from accident.

2. *Occupational Diseases:* Disease in any form is excluded, except where it results naturally and unavoidably from accident.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Employee suffering from successive injuries is not entitled to compensation for both injuries at the same time. If permanent injury be followed by another, also permanent, compensation allowed for both, by extending period, but not increasing weekly rate of payments, maximum period 500 weeks. If loss of a member, following previous loss of another member, produces total permanent disability, employer's liability is for subsequent injury only; but further compensation may be payable out of a "Second Injury Fund." Permanent disability previously sustained in another employment not to be considered in arriving at degree of incapacity for which compensation is payable.

South Dakota

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless dut to wilful misconduct (including intention to injure self, intoxication, and wilful failure, or refusal to use safety appliance furnished by employer or to perform statutory duty). Not to include disease except as it results from such injury.

2. *Occupational Diseases:* Excluded, except such cases resulting from injuries by accident. However, under "South Dakota Occupational Disease Disability Law," disablement or death resulting from any of 24 occupational diseases listed in a schedule, "contracted" and "incurred," as defined, to be treated and compensated to the same extent as an injury by accident under the Workmen's Compensation Law, unless caused by wilful misconduct or wilful self-exposure, as defined.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of employee previously disabled and drawing compensation, compensation for each subsequent injury is to be apportioned according to the percentage of disability caused by respective injuries. When an employee who has previously lost, or lost the use of, one hand, one arm, one foot, one leg and one eye, becomes permanently and totally incapacitated through the loss of use of another member or organ, the employer shall be liable only for compensation payable for the second injury, but the employee shall be paid the balance due for permanent total incapacity from the "Second Injury Fund."

Tennessee

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Injuries by accident arising out of and in the course of employment, unless purposely self-inflicted or due to wilful misconduct, intoxication, or refusal to use safety appliance or to perform a statutory duty.

2. *Occupational Diseases:* Partial or total disability or death from nine occupational diseases scheduled and no others arising out of and in the course of employment, as defined, are covered. Employer may elect broad coverage of occupational diseases.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Where permanent total disability results from the loss or loss of use of a member or organ ensuing upon the previous loss or loss of use of a hand, arm, foot leg, eye or

the loss of hearing of one ear, additional compensation to make the total equal to payments for total disability shall be payable from the "Second Injury Fund."

Texas

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Injuries consisting of damage or harm to physical structure of body sustained in course of employment, and such disease or infection as may naturally result therefrom, unless caused by intent to injure self or another or by intoxication, or by act of God, with certain exceptions, or by third party intentionally and for personal motives.

2. *Occupational Diseases:* 45 occupational diseases and infections and those only, listed and enumerated in the schedule, covered in the same manner as injuries by accident when the employee has not wilfully or falsely represented that he has not been previously afflicted. The last employer is liable for all compensation payable. Occupational disease defined as such disease which is due to the nature of an employment in which the hazards of such disease actually exist, and is characteristic thereof and peculiar to the trade, occupation, process or employment, and is actually incurred in such employment. The provisions do not apply in cases of incapacity or death in which the last injurious exposure occurred prior to the effective date.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case previous injury contributes to incapacity of employee subsequently injured, the compensation payable is that to which the employee would be entitled had there been no previous injury. However, if an employee has previously lost, or lost the use of, one hand, one arm, one foot, one leg or one eye and becomes permanently and totally incapacitated through the loss or loss of use of another member or organ, after the completion of payments for second injury, employee shall be paid the remainder of compensation due for total permanent incapacity out of the "Second Injury Fund." Where an occupational disease is aggravated by any other non-compensable disease or infirmity, or where incapacity or death from any other cause is aggravated, prolonged, accelerated, or otherwise contributed to by an occupational disease, compensation is reduced in accordance therewith.

Utah

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless purposely self-inflicted.

2. *Occupational Diseases:* Excluded, except such cases as result from injuries by accident. However the "Utah Occupational Disease Disability Law" provides that compensation is payable for total disablement or death from any one of 27 occupational diseases specified which can be fairly traced to the employment as a proximate cause, where disability results within 120 days or death occurs within one year from the last day of work for employer against whom compensation is claimed.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of permanent partial disability sustained by the employee who has previously incurred similar disability, so that the compensation provided for the disability resulting from combined injuries is greater than would have been payable for the later injury alone, employer shall be liable for compensation for the later injury, the balance being payable out of a special fund.

Vermont

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident arising out of and in the course of employment, unless caused by employee's wilful intent to injure himself or another, by intoxication, or failure to use safety appliance.

2. *Occupational Diseases:* Excluded, except such cases as result from injuries by accident.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* If an employee who has previously lost, or lost the use of, one hand, at or above the wrist joint, one arm at or above the elbow joint, one foot at or above the ankle joint, one leg at or above the knee joint, or one eye, becomes permanently and totally incapacitated through the loss or loss of use of another such member or organ by a compensable accident, the employer shall be liable only for the compensation payable for such second injury, but in addition thereto and after the completion of the payment therefor, the employee shall be paid the remainder of the compensation that would be due for permanent total incapacity out of the "Second Injury Fund."

Virginia

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries by accident or occupational disease, as defined, arising out of and in course of employment, unless due to wilful misconduct (including intention to injure self or another, intoxication and wilful failure or refusal to use safety appliance or perform statutory duty).

2. *Occupational Diseases:* Occupational diseases as specifically defined and enumerated, including asbestosis and pneumoconiosis, are covered. Employer and carrier at time of last exposure are liable without right of contribution. Employee may waive compensation for aggravation of an occupational disease. Employer may reject the schedule of occupational diseases listed, and elect full coverage.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Employee suffering from successive injuries is not entitled to compensation for both injuries at the same time. Where second injury follows one included in specific schedule, compensation for latter is suspended during period of compensation for second injury. If permanent injury be followed by another, also permanent, compensation allowed for both, by extending period, but not increasing weekly rate of payments, maximum period 500 weeks. If successive injuries produce total permanent disability, payments for previous disability would be credited on award for total permanent disability. Permanent disability previously sustained in another employment not to be considered in arriving at degree of incapacity for which compensation is payable.

Washington

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries sustained in course of employment, unless deliberately self-inflicted or sustained in the commission or attempted commission of a crime. "Injury" defined to mean a sudden and tangible happening, of a

traumatic nature, producing a prompt result and occurring from without.

2. *Occupational Diseases:* The term "occupational disease" means such disease or infection as arises naturally and proximately out of extra-hazardous employment, and is compensable from the same fund and in the same manner as accidental injuries.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of further injury to employee who has previously received a lump sum payment, future compensation is to be computed with regard to combined effect of injuries and past compensation. If subsequent accident results in permanent total disability, the usual pension is to be paid, notwithstanding the payment of a lump sum for prior injury. In case of injury resulting in aggravation of permanent partial disability, compensation is to be adjusted with regard to previous disability and degree of aggravation thereof. When previous disability from injury or disease combined with further injury or disease in employment causes permanent total disability, cost rate of employer is charged with disability solely caused by latter and balance is payable out of "Second Injury Fund." Where pre-existing disease delays or prevents recovery, compensation is to be awarded only for the period and/or extent of disability which the injury alone would have caused were it not for the disease.

West Virginia

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries sustained within the State in the course of and resulting from employment, including silicosis, unless self-inflicted or due to wilful misconduct, wilful disobedience to posted rules, intoxication or failure to use safety appliance.

2. *Occupational Diseases:* Compensation is payable for the disease of silicosis or for death resulting therefrom if the employee has been exposed to the inhalation of silicon dioxide dust in harmful quantities over a period of not less than two years in the state, and if the disease was not contracted by "wilful self-exposure" or misconduct.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Where the loss, or loss of use, of a hand, arm, foot, leg or eye is followed by another injury in same employ, resulting in total permanent disability, Commissioner must allow the subscriber credit on his account for the partial permanent disability already received. Where subsequent injury was received in different employ, compensation for total permanent disability must be paid by Commissioner out of any funds at his disposal, after charging to last employer subscriber an amount equal to the partial permanent disability attributable to the last injury.

Wisconsin

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Mental or physical harm to an employee, caused by accident or disease, including damage to or destruction of artificial members, dental appliances and teeth, sustained in performing service growing out of or incidental to employment where not intentionally self-inflicted. No compensation payable for death or disability in so far as caused or aggravated by unreasonable refusal to submit to medical treatment.

2. *Occupational Diseases:* The term "injury" includes mental or physical harm whether caused by accident or disease. In case of disease, last day of work for last employer whose employment caused disability is date of injury; intermittent periods of temporary disability create separate claims; and permanent partial disability creates claim separate from claim for subsequent disability due to intervening cause. Claim must be made within two years after injury or death or from date when employee or dependent knew or ought to have known the nature of the disability and its relation to the employment.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* In case of permanent disability equivalent to 15% or more of permanent total disability, followed by further permanent disability equivalent to 15% or more of permanent total disability, additional compensation is payable from special fund derived from payments by employers to State, equivalent to the amount which would be payable for previous disability if it had resulted from such injury, or the amount payable for further disability, whichever is the lesser; but if said disability results in permanent total disability, the additional compensation shall be in such amount as will complete the payments which would have been due had permanent total disability resulted from such injury.

Wyoming

AGGRAVATION OF PRE-EXISTING CONDITIONS:

1. *Coverage of Injuries:* Personal injuries sustained, in extra-hazardous employments (as listed and defined), unless due solely to culpable negligence of employee while in or about employer's premises or elsewhere in places where employer's business requires employee's presence; but not including injuries occurring on the way to or from work (the proximate cause of which is not employer's negligence), nor injuries caused by wilful act of third person against employee for personal reasons or because of his employment.

2. *Occupational Diseases:* Excluded, except such as directly result from injuries incurred from employment.

II. SECOND INJURIES:

1. *Effect of Previous Disabilities:* Where there has been previous permanent partial disability, the award for a subsequent injury is to be determined by deducting therefrom the award for previous disability. If an employee who is permanently partially disabled by the loss, or loss of use, of one hand, one arm, one foot, one leg or one eye receives a subsequent compensable injury in extra-hazardous employment resulting in additional permanent partial disability so that the combination of the two injuries results in permanent total disability, the employer shall be liable for the subsequent injury only, and the difference between the employer's liability and an award for total permanent disability shall be paid from the "Subsequent Injury Fund" created by appropriation and contributions by employers.

BOOKS

Diagnosis

GUIDE TO DIAGNOSIS OF OCCUPATIONAL DISEASES, Industrial Health Division, Department National Health and Welfare, Ottawa, and Division of Industrial Hygiene, Department of Health, Ontario. English edition, King's Printers, Canada, 1949, pp. 317, $1.00. (A French edition is also being prepared.)

IN THE United States near 85% of all occupational diseases receive medical attention from physicians not directly identified with industry. It is believable that in Canada a similar situation may exist. At once the implication looms that all physicians should possess a working familiarity with the commoner occupational diseases. Toward this objective, two Canadian governmental agencies dealing with occupational health have joined forces in the preparation of this extensive manual pointed to the diagnosis of occupational diseases. While a selling price is mentioned on the title page, it is known that large numbers of this book will be widely distributed gratuitously within the industrially active Provinces.

The contents of this book are well organized into lists and tables. The first portion of the book, and a lengthy one, is devoted to an alphabetic listing of commoner trades and associated with them are their characteristic exposures. Another portion of the book provides a listing of occupations along with their respective skin irritants. Duly for every mentioned exposure an alphabetic section is provided presenting in highly condensed form the individual substances, their chemical properties, uses, mode of entry into the body, physiologic action, signs and symptoms of damage, maximum allowable concentration when available, and state of flammability. The average item consumes less than one page, and so important an item as lead and its compounds is encompassed in only four pages.

For the purpose of the practicing physician, the intended reader, this guide is admirable both as to its contents and its omissions. The experienced industrial hygienist will find omitted hundreds of substances of known toxicity but their extent of use and the frequency of clinical cases are so low that their exclusion is praiseworthy.

The title page reveals no individual authors, authorship being credited to the staffs of the two participating agencies. However, it is easy to discern the fine guiding hands of the respective directors of the participating governmental divisions, DR. F. S. PARNEY and DR. J. G. CUNNINGHAM.

—CAREY P. MCCORD, M.D.

Industrial Poisons

THE ANALYTICAL CHEMISTRY OF INDUSTRIAL POISONS, HAZARDS, AND SOLVENTS, Vol. I; Morris B. Jacobs, Ph.D., Second Edition, Interscience Publishers, New York, 1949, pp. 788, $12.00.

GOOD as was the First Edition of this book (1941) this Second Edition is highly superior. With certain hand the author has brushed aside the outmoded and replaced all such with the immediately pertinent. The earlier emphasis on the gases of warfare properly has given way to information on the radioactive isotopes. This is characteristic of this full-sized text devoted to some 2000 substances known to industry's enterprises. Foremostly, this is a book of chemical and physical procedure. Most book publications in the general domain of occupational health have signally lacked sufficient and exact methods for the chemical appraisal of suspected agents. This book is replete in just those items some others failed to embrace. But it may not be inferred that the coverage is precisely limited to chemical and physical procedures. Wherever available, there appears a judicial presentation of physiologic actions and tolerance levels. Clinical considerations form no extensive portion of the text. In admirable fashion, the author adheres to his book's title.

The year 1949 was a productive one for books on industrial toxicology. Chief among them are Hamilton and Hardy's "Industrial Toxicology," Patty's "Industrial Hygiene and Toxicology," Volumes I and II, and the present one. Were the facts unknown, it would be reasonable to speculate that some degree of connivance might earlier have been arranged. Outstandingly, the Hamilton and Hardy text is directed to industrial etiologies; the present book provides chemical and physical measurements; the Patty two volumes have, as one prominent quality, the control of unwanted industrial exposures. This triad, along with the official publication of the Canadian governmental agencies in occupational health, "A Guide to the Diagnosis of Occupational Diseases," well encompasses the old and the new in industrial toxicology.

In 1910 the First National Conference on Industrial Diseases memorialized the then President of the United States in language including these apologetic words: "Practically all the standard works of reference on occupational diseases are by English or Continental authorities. There is no modern treatise on the subject by an American authority on industrial hygiene." Because of books like that of Jacobs, that statement never in truth again may be made. —CAREY P. MCCORD, M.D.

Up to Date on Foods

NUTRITIONAL DATA (formerly "Nutritional Charts"), compiled by WOOSTER, H. A., JR., and BLANCK, F. C. Heinz Nutritional Research Division, Mellon Institute. Pittsburgh; H. J. Heinz Company; 1949; 114 pp.; Free.

NEW in format, an old standby of the nutrition conscious industrial physician has made a reappearance after 12 editions and 650,000 copies. This compilation of pertinent data in nutrition offers tabulated and summarized information in the areas of the vitamins, the essential elements, proteins and amino acids, the availability of nutrients, signs and symptoms of malnutrition, metabolism and action of foods, human nutritive requirements, and diets for good nutrition, and provides tables of food composition and nutritive value.

The compilers state that the material represents a conservative statement of existing knowledge and opinions. The new section on proteins reflects the increased emphasis in this direction, and the material on vitamins, essential elements, and intermediary metabolism among other topics has been "re-cast and modernized."

To those planning diets—physicians, nurses, or health educators—the 20 pages devoted to the composition and nutritive value of foods will prove of invaluable aid. For the person desiring a brief,

easily read, well printed and contemporary summation of nutritional information, this will serve as a handy reference manual. Plastic-bound and conveniently sized, the book can be used as authentic source material in the execution of a program of industrial nutrition. The several pages devoted to the manufacturer's food products do not detract from the worth of the publication. Its addition to the industrial medical bookshelf is recommended.

Physician Poet

MEDICINE COULD BE VERSE, by CHARLES G. FARNUM, M.D., with an Introduction by STRICKLAND GILLILAN. 128 Pages; $3.00. Published by Exposition Press, 251 Fourth Avenue, New York 10.

OUR FAVORITE author dedicates one of his books to "The Poet in Every Man." He adds "for such there is"—and therein he states a profound truth. "People fancy they hate poetry, but they are all poets and mystics." Illustrative examples of a sort are the poetic comparisons that enliven everyday conversation—"diamond in the rough," "heart of gold," "pulling power," "streamlined," "hitting the high spots"—even the tightened expressions of slang. Citing these and others, LOUIS UNTERMEYER, in the introduction to one of his anthologies, says: "Language is continually being made swift and powerful through the medium of poetic phrase." But better examples are the many—sensitive to rhyme and meter—who dress their thoughts in the lilt that uses both. These are intrepid souls if they hope to find much of a market. But as a rule they don't; they write as an avocation, and are happy if their verses attain the permanency of a home between covers. This, however, is considerable, for they do reach an audience. The innate yearning of "every man" for more than stereotyped expression makes him appreciative; and his responsive gamut runs from Boewulf to Chaucer, to Eddie Guest, to Whittier, Whitman, Masters, Tennyson, Browning, Masefield, to T. S. Eliot, even to e. e. cummings—with everything from the "Song of Solomon" to the "Sweet Singer of Michigan" in between. Actually therefore, it is only the poem not written that's never read. And so, having written, and being read, the "poet in every man" who gets his verses published has his name added, as it were, to the long roll of the immortals. It is there, even if it doesn't stand out in the bold print reserved for the masters.

Back in 1915, when he was Medical Director of the Avery Manufacturing Company (farm implements) in Peoria, Illinois, and one of the seven incorporators of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, his fellows in industrial medicine didn't suspect that there was "a poet" in DR. CHARLES G. FARNUM. But there was, and shortly he began to make it known. For many years he conducted a column of verse in the *Peoria Medical Journal*. Then, about 10 years ago, this was transferred to the *Illinois Medical Journal;* and more recently some of his writing were published in *J.A.M.A.* and other magazines. This is his first book. He calls it "humorous" verse, and, in large part, it is. His 120 subjects offer a wide range for the comments which he casts into a variety of forms; and his combinations of subject and form often display a "tongue-in-cheek" apposition of incongruities, which elicits the appreciative chuckle. RUSSELL MACFALL, in *Chicago Tribune Book Section*, January 8, 1950, says of him: "DR. FARNUM is as orthodox in poetry as he probably is in medicine; he is a respectable parodist of W. S. Gilbert and Ogden Nash (which is almost like picking a fight with Joe Louis); he pays respects in rhyme to the doctors' hobbies, golf and fishing; he wrings uncertain merriment from the names of diseases and what they do to his patients; and not infrequently he coins a phrase, a line or even a verse and poem that any anthologist would be happy to include." That is a fair appraisal. DR. FARNUM'S verses are all to be enjoyed, many to be re-read, some to be remembered. Among his gentle barbs and broad satires he has an occasional serious note. The simple experience which he calls "The Broken Journey" made this reviewer want to reach out and shake his hand. It is the poet speaking—not the rhymester: "For a number of days I walked hand in hand with Death. In my illness-beclouded mind it seemed the natural thing to be doing. We were on a journey together. I had no fear, no resentment, no objection; only indifference. He was not a grim monster leading me into extinction, nor a kindly friend taking me away from bodily pain. He was merely present. Then by some strange quirk of Fate I abandoned the journey, and our ways parted. As I left his grey presence, he said, in friendly way, 'Auf Wiedersehn.' And I replied, 'Jawohl.'"

Another Book—And a Plea

THE TYRANNY OF WORDS," by STUART CHASE. Published in 1938 by Harcourt-Brace—$2.75.

THIS excellent book is slow reading, as are most books which provoke analytical thinking. The invaluable contribution which this book will make to the thinking of the person who reads it carefully and extracts its value, will be the ability, discomforting at times, to sort out the words, printed or spoken, of himself and others, into those that are "high abstractions" and those that "operate."

"The high abstraction" has no fixed meaning, as it may convey a different meaning to each listener, and there is no meeting of the minds. The words which "operate" have a clearly defined meaning over which the minds must meet because they describe realities—whether of things or ideas—in such a specific way that both the listener and the speaker see the word "at work." With devastating effect, the author extracts "high abstractions" from sample sentences and substitutes "blah-blah" in their place, and from the instant the reader grasps the full significance of this book, he will never view what he reads, hears, or utters in the same way again.

Unfortunately, "blah-blahs" are not confined to any one field, such as politics, but honeycomb every phase of life and are not rare enough in the field of industrial medicine. Of "high abstractions," we have had a plethora. Some are delightful, and we can afford the luxury of a few. In certain fields, however, the continued use of "high abstractions" instead of terms which "operate" is actually hindering progress in industrial medicine.

In no phase is the need for making words "operate" so urgent as it is in the use of the basic terms which describe our professional functions. How do the following words operate: "industrial medicine," "industrial health," "occupational health," "occupational disease," "industrial hygiene?" Do they mean the same to all of us, or do they have one meaning for the clinician, another for the medical director, another for the plant physician, another for the public health physician, another

for the public health engineer, another for the medical administrator, and a different one yet for the layman, be he employer or editor? Do they clearly define fields of activities which allow the proper assignment and apportionment of function and education to those best able to function or educate in that segment? Or are they "high abstractions," lending a Babel-like atmosphere to discussions on education, field of activity, or function, because each discussant ascribes a different meaning to the terms used?

In my desk are unfinished manuscripts attempting to describe the spectrum of the whole field of industrial medicine, each of which was started with the conviction that it would be a simple undertaking. I visualize one end of the spectrum as consisting of activities chiefly concerning environment, and at that end is the highly scientifically-trained industrial hygiene engineer or chemist—or, in the new industrial field of the atom, the super-trained physicist. As we pass across the spectrum, this activity shades into the more ordinary field of the industrial hygiene engineer in everyday industry and overlaps more and more with the increasing shading of the industrial physician—and finally on the opposite end of the spectrum, the field is highly colored by the clinician, the administrator, and finally the compensation practitioner, the general practitioner of medicine, and the activities chiefly concerned with "people." My difficulty has not been in my own concept, but in finding terms which would convey to the reader the meaning I have in mind. Always I have found that I have ended up defeated by the lack of clear-cut definitions of the terms we must use. Until these "high abstractions" operate for each of us in the same way, I do not believe we can expect to have the confusion in function and education clarified.

Will those of you who have read or may be prompted to read "The Tyranny of Words" please keep our own professional sub-divisions in mind and contribute to the "kitty" of ideas, so that ultimately the words which define our life's work will no longer be "high abstractions" but will "operate," and at least carry a reasonable semblance of commonly accepted and understood meaning for all groups and individuals. Collectively can we help convert the "high abstractions" of this comment into words that "operate?"

—CHRISTOPHER LEGGO, M.D.

LETTERS

Get Back of H. R. 5577

TO THE EDITOR: Human conservation in the form of rehabilitation of physically disabled persons has added many valuable employees to the rolls of industry. In the past six years approximately 280,000 men and women have been rehabilitated for useful work through the State-Federal partnership of services for the handicapped. The greatest dividends from this effort lie in its returns in human dignity, in greater happiness, and in individual and family security. In addition, however, this restorative program has paid dividends in dollars and cents. The persons aided since 1943 have increased their earnings and the nation's purchasing power by more than 900 million dollars, and have paid into the Federal treasury in income taxes alone more than 67 million dollars.

Opponents in Washington are exerting every energy toward a destruction of this program by wanting the rehabilitation functions transferred from the U. S. Office of Education to the Department of Labor. They have proposed, in H.R. 3905, a "separate, independently-administered program of grants to the disabled needy who are 'unfeasible' of rehabilitation." Not only would such a step create administrative duplication and waste, but it would place these persons in a special, segregated category of relief recipients. Are not the physically disabled already sufficiently burdened without further pointing up their differences from others? They, like everyone else, want, most of all to be treated as nearly as possible like normal human beings.

An administrative measure has been proposed, H.R. 5577, that would improve even more the services to the handicapped rendered by the Office of Vocational Rehabilitation. Endorsed by the State agencies and the Director of the Bureau of the Budget, this bill will do the best possible job for the handicapped. It will provide adequate rehabilitation centers, adequate workshops for the blind and severely disabled, and liberalized business enterprise programs so that the disabled may run small businesses. For the home-bound it offers sound marketing and production systems. Finally, it will liberalize training programs and establish a basic research and training center for the blind and severely handicapped.

It is the duty of physicians in industry who have realized the advantages of having skilled, trained, well-placed handicapped workers, to assist in producing happy, self-sustaining individuals rather than miserable stigmatized dependents on society. To this end physicians must aid in the creation of stabilized families, in the salvaging of productive power, and in the strengthening of the industrial community. This they can do by supporting verbally, in writing and in action *H.R. 5577.*

To avert further bungling and log-rolling involving human beings they should back *H.R. 5577.* To provide a stable industrial manpower and an upward-looking population free from subsidy, they must tell voting Washington that they favor *H.R. 5577.* This will be one very effective way of helping the handicapped to help themselves.

—MEDICAL DIRECTOR

Mystery

TO THE EDITOR: In your December issue, in "Slips that Pass in the Smog," you referred to the statement in the Davidson article in *Colliers* for October 22, 1949, that in Los Angeles the oil refineries "poured a total of 700,000 tons of sulphur dioxide into the air every day." Maybe you read *Colliers.* If you do, you probably saw the editorial correction which appeared in that magazine for December 17, 1949. They say: "The correct figure is 700 tons a day, which is how Bill Davidson's manuscript read. The three extra zeros were mysteriously picked up somewhere in the mechanical transition from manuscript to printed page."

—OBSERVER

CAREY P. McCORD, M.D.
Consultant Editor

OUR NEW EDITORS

JEAN SPENCER FELTON, M.D.
Editor

CAREY P. McCORD, M.D., as *Consultant Editor*, and JEAN SPENCER FELTON, M.D., as *Editor*, are now in charge of the editorial policies of INDUSTRIAL MEDICINE AND SURGERY.

Dr. McCord

DR. CAREY PRATT McCORD needs no introduction to the readers of this Journal, nor to the field it serves. As an authority in all phases and aspects of the science of industrial medicine and industrial hygiene his reputation is international. And his acquaintance with the men who are engaged in both is likewise transcendent of geographical bounds. He is distinguished as industrial physician, scientist, industrial hygienist, administrator, experimenter, author, teacher, and consultant; for a career as medical adviser of big business and consultant for corporations, associations and trade unions; for "a legion of 'firsts' in the discovery of causes and the evolution of preventives; for a succession of scientific additions to the armamentarium of diagnosis and treatment; for an array of hundreds of medical articles, studies and reports,"* and for his three books, "Industrial Hygiene for Engineers and Managers" (with Floyd P. Allen), 1931, "A Blind Hog's Acorns—Vignettes of the Maladies of Workers," 1945, and "Odors—Physiology and Control" (with William N. Witheridge), 1949. He is one of the distinguished company who have received the WILLIAM S. KNUDSEN AWARD for outstanding achievements in industrial medicine. It was given him in 1947. Also he is distinguished for the qualities that add up to an engaging and extraordinary personality. His interests are wide, and on the subjects that enlist his attention his knowledge is cyclopedic. In matters of toxicological significance he is a veritable "walking laboratory." His command of the written word is outstanding, and he writes with a distinctive, and enviable, charm of style. More, he is blessed in a marked degree with that elusive and rare "editorial sixth sense" which, in an editorial position, may encompass the difference between adequacy and brilliancy. His will be a strong and sure hand on the helm....

Dr. Felton

DR. JEAN SPENCER FELTON was born at Oakland, California, in 1911. He received his A.B. at Stanford University in 1931, and his M.D. at Stanford University School of Medicine in 1935. After internship and a residency in surgery at Mt. Zion Hospital, San Francisco, 1935-36, he was resident in surgery at Dante Hospital, San Francisco, 1936-38. Licensed in California in 1935, he practiced medicine and surgery in San Francisco—part-time, 1935-38, full-time, 1938-40. In December, 1940, he began extended active duty with the U. S. Army, as First Lieutenant, Medical Corps, at Fort Lewis Station Hospital, Washington. In June, 1941, he was transferred to the San Francisco Port of Embarkation, serving as transport surgeon on the Army transports *St. Mihiel* and *President Pierce*, between San Francisco and Honolulu, Manila, Hong Kong and Shanghai.

His industrial experience dates from November, 1941, when he was appointed Industrial Medical Officer for the San Francisco Port of Embarkation. During his four years there he established and administered a medical care program for 20,000 Federal civilian employees. This he described in two articles, published in 1945. Also he designed and supervised the construc-

*A study of DR. McCORD, in the manner of the "profile" character sketch, was a feature of INDUSTRIAL MEDICINE for September, 1948. A biographical summary will be found in the current "Who's Who in America," and a more extended sketch appears in "Who's Who in Industrial Medicine" (1948-1950).

tion of the $27,000 Port Dispensary at Fort Mason, San Francisco, an outpatient clinic rendering all-specialty service; supervised the medical staff of 132 civilian employees, including 32 graduate nurses, and 27 Army officers at Fort Mason, Oakland Army Base, Fort McDowell, and Camp Stoneman; prepared the "Standard Operating Procedure of the Army Industrial Medical Program at the San Francisco Port of Embarkation," which was adopted by the Army Chief of Transportation for all Ports of Embarkation; and arranged, and served as Chairman of, the First Annual Conference in Industrial Nursing held at Fort Mason, November, 1944, to March, 1945, and consisting of 15 lectures by leaders in the fields of industrial medicine, nursing and hygiene. Leaving the Port in June, 1945, he served a while as Industrial Medical Officer for Army Service Command O (Sixth Army) in the Philippines and Japan. In April, 1946, he received his Army discharge as Lieutenant Colonel, and since then he has practiced in Tennessee, where, at Oak Ridge, he is Medical Director of the Oak Ridge National Laboratory, responsible for the industrial health program, which serves 2000 employees and includes preventive medical procedures, health education, industrial hygiene, mental hygiene, and research activities in industrial health methods and practices.

He is a Fellow of the American Medical Association, the American Public Health Association, and the American Academy of Occupational Medicine; a member of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION, the Tennessee State Medical Association, the Roane County Medical Society, the Southern Medical Association, and the American Medical Writers' Association. He is also a member of the Tennessee State Children's Code Commission, and of the Youth Service Committee, Oak Ridge Welfare Council. In the A.M.A. he is Secretary of the Section on Preventive and Industrial Medicine and Public Health, and a member of the AMA-USPHS Joint Committee on Research in Health Education in Industry. He is Consultant in Industrial Medicine for the Tennessee State Medical Association, and for the Veterans Administration, Southeastern Area, and is this year's President-Elect of the AIHA Tennessee Section. He maintains his status in the Army Reserve, as Lieutenant Colonel, Medical Corps.

He has been one of the Associate Editors of INDUSTRIAL MEDICINE AND SURGERY for several years, and is a member of the Board of Editors of *Excerpta Medica*, Section IV, The Netherlands, and of the Editorial Advisory Board of the *Journal of Rehabilitation*. He also edits the monthly abstract section of the *Journal of the Tennessee Medical Association*. His writings include 33 major articles, of which 13 were published in INDUSTRIAL MEDICINE,* seven in *Occupational Medicine* and four in *Industrial Nursing;* together with five more in press. In addition, he has just completed his book, "Health in Industry —A Master Plan," scheduled for early publication by McGraw-Hill. The excellent quality of his writing is indicated by the fact that in March, 1948, at Boston, he was given the "Citation for Excellence in Medical Authorship," awarded yearly by the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS. The basis of this recognition was his article, "Orienting the New Employee in the Services of the Health Department," which appeared in INDUSTRIAL MEDICINE, November, 1947.

As part of his belief that industrial physicians should interest themselves in public relations activities, DR. FELTON'S avocation is public speaking, and he welcomes the opportunity to talk, particularly to management groups, on industrial health subjects. He regularly serves as a Lecturer in Industrial Sociology at the University of Tennessee.

He is young in years, studious in habit, mature in thought. His record since he became initiated in industrial medicine in 1941 has been an effective and enhancing demonstration of the qualities mentioned when he was given the Army Commendation Ribbon for commendable service in the Port Surgeon's Division, San Francisco Port of Embarkation from January 15, 1944, to June 30, 1945. The citation praised "his tireless energy, his initiative, and his intelligent and practical insight into industrial activities...."

Associate Editors

CARL T. OLSON, M.D., Division Medical Director, Loss Prevention Department, Liberty Mutual Insurance Company; JAMES KEANE STACK, M.D., F.A.C.S., Chief Surgeon, Chicago & North Western Railway; and CHESTER C. GUY, M.D., F.A.C.S., Chief of Surgery, Illinois Central Hospital, Chicago, join our group as Associate Editors.

DR. OLSON is Chairman of AAIP&S Committee on Workmen's Compensation and Insurance, and is arranging the Section Meeting on Workmen's Compensation which will be a feature of the Tuesday afternoon program at the Association's Thirty-Fifth Annual Meeting, April

*The first two, in which he described his initial work, are as follows: "The Personal Side of the Army Industrial Medicine Program at the San Francisco Port of Embarkation," INDUSTRIAL MEDICINE, August, 1945; "The Army Industrial Medical Program at a Port of Embarkation," INDUSTRIAL MEDICINE, November, 1945.

23-29, 1950. He has published a number of articles in INDUSTRIAL MEDICINE, notably on tantalum and its surgical uses, prepared while he was Medical Director of Fansteel Metallurgical Corporation. His present interests are primarily the extension of preventive industrial medicine, and, after that, prepaid medical care and workmen's compensation and insurance. The contacts with management which are a considerable part of his work with Liberty Mutual enable him to be an effective protagonist of prevention.

DR. STACK, Fellow of the American College of Surgeons, is a specialist in orthopedics. He is Associate Professor of Bone and Joint Surgery, Northwestern University Medical School, and Attending Orthopedic Surgeon at Passavant Hospital and Cook County Hospital, Chicago.

DR. GUY is Secretary of the AMERICAN ASSOCIATION OF RAILWAY SURGEONS. He is a Fellow of the American College of Surgeons, and the International College of Surgeons, and a member of the American Board of Surgery.

Dr. McNally Retires

WILLIAM D. MCNALLY, M.D., nationally known authority on toxicology, retired from active practice January 1, 1950, turning over his toxicological work to DR. Y. T. OESTER, Professor of Pharmacology at Loyola University, Chicago. DR. MCNALLY was born in 1882; graduated in chemistry at the University of Michigan in 1905; was assistant instructor in chemistry at the University of Illinois, 1905-06; attended the University of Chicago, 1916-17; graduated M.D. at Rush Medical, 1920; interned at St. Joseph Hospital, Chicago; and later took post-graduate work in Vienna. Shortly after graduation at Michigan, he was engaged as a chemist at Armour & Company, where he remained three years. In 1910 he became Chief Chemist for the Chicago Health Department, and in June, 1913, he established the first Laboratory of Toxicology in the Americas. At Rush Medical he was associated with the late DR. WALTER S. HAINES in the Department of Materia Medica and Toxicology, and, following his graduation, he became Associate Professor of Medicine, continuing in this appointment until 1941, when Rush Medical became part of the University of Illinois.

DR. MCNALLY has written extensively on toxicological and industrial subjects, many of his articles appearing in INDUSTRIAL MEDICINE. Notable among these was his "Industrial Manganese Poisoning" (4:11, 581-599, November, 1935) which is still used as a text. He is distinguished for the large number of his investigations in chemistry and toxicology and his thousands of postmortem studies. In 1937, appeared his 1022-page textbook, "Toxicology," which was well received and had a large sale. Two years later, his second book, "Medical Jurisprudence and Toxicology," was published by Saunders. He has long been in "Who's Who in America," and a more detailed biography may be found in "Who's Who in Industrial Medicine."

His career has been highlighted by numerous interesting experiences as an expert witness in criminal trials, particularly murder cases, during the last 40 years. He testified in the famous Orpet case, in which he found that Marian Lambert died because of potassium cyanide, although someone had "planted" sodium cyanide on the girl's overcoat just before the trial began. The overcoat was later examined by DRS. WALTER HAINES and CARL MINER, who confirmed that the cyanide salt on it was different from that found in the dead girl's stomach. In his book "Without Fame," Otto Eisenschiml, the author, says: "What made this case so noteworthy was that, for the first time, chemistry had saved an innocent man's life....It was also memorable for the fact that DR. WILLIAM D. MCNALLY, chemist for the Coroner's office, stated to the prosecuting attorney that as a chemical expert he was a witness 'for truth and truth alone.' This little speech," wrote Eisenschiml, "should have been given world-wide prominence; it could well serve as the motto of expert witnesses for all time to come." DR. MCNALLY was a witness also in the notorious Loeb-Leopold case, and in the prominent Marshal murder case in Tuscon, Arizona. He has been called to all parts of the country as an expert. When the large number of cases of silicosis began to appear in the early thirties, he examined, chemically, the lungs of 100 persons of all ages and dying from various causes, for their silicon dioxide content, revealing an average of 0.13 mg. silicon dioxide per gram dried lung.

IN HIS retirement, DR. MCNALLY plans to reside in Mobile, Alabama, and to write about the many interesting poison cases in which he has taken an active part. He will continue as an Associate Editor of INDUSTRIAL MEDICINE AND SURGERY.

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The "Half-Century" in Industrial Medicine

WE HAVE a suggestion for those interested in the argument that December 31, just passed, marked the end of the first half of our century and January 1 the beginning of the second half. It is that they count off their income tax in dollar bills, and when they lay down the *fiftieth* one of any hundred of the debt, they announce to the tax collector that it is the *first one* of the second half of the hundred....The argument, however, is pointless; time (like the tax collector) can't be short-changed. We mention it only because, in a way, we're in it, as we've been asked, from several directions, what we consider the most outstanding happenings in our field during the "half-century since 1900." One request is for our opinion on "the 10 most important events in industrial medicine in the last 50 years." That one saves the arithmetic.

As a matter of history, 50 years (or, for the half-century addicts, 49) is almost the lifetime of industrial medicine as we know it. In many respects it is also the span of much of our present-day mode of living. "The accepted features of our civilization have been developed during this era—movies, radio, television, airplanes, automobiles, skyscrapers, mass production, labor unions, giant corporations, social security, atomic energy, to mention just a few. Morals, manners and customs have been revolutionized." Technology, inventions and scientific advances have altered our whole face of life. In all of this industrial medicine has come as far and been as significant as any of the more evident influences that have been at work. And many important things have happened to it, and inside of it, and because of it—so many, indeed, that probably any election of a limited number from all of them to be designated as the most important can be little more than an expression of opinion. It is a good idea, however, to try it; the attempt will emphasize the long way traveled and the wonderful progress accomplished. There are, of course, several bases upon which selections can be made. One is to give the word "event" a literal meaning. Something occurred, an incidence of time, place and circumstance. This, in terms of the developments, issues, connotations and results implicit in its consequences, may have been of great importance. Tentatively, then, we suggest the following as among such events:

The enactment of the first workmen's compensation law (circa 1906).

The organization of the National Safety Council (1911).

The establishment by the U. S. Public Health Service of its Division of Industrial Hygiene (1914).

The organization of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS (1915).

The establishment of the Harvard School of Public Health (1919).

The establishment by the American College of Surgeons of the "Minimum Standard for Medical Service in Industry," for compliance with which the College awards its Certificate of Approval (1930).

The establishment of the journal, INDUSTRIAL MEDICINE (1932).

The creation by the American Medical Association of its Council on Industrial Health (1938).

OF EQUAL importance might be also the publication of such texts as "The Occupational Diseases," by GILMAN THOMPSON (1914), "Industrial Medicine and Surgery," by HARRY E. MOCK (1921), "Industrial Health," by HAYHURST and KOBER (1924), "Industrial Poisons," by ALICE HAMILTON (1925), "Essentials of Industrial Health," by C. O. SAPPINGTON (1943); the establishment of the *Journal of Industrial Hygiene* (1919), and *Occupational Medicine* (1945); the creation by the American Medical Association of its Section on Preventive and Industrial Medicine and Public Health (1922); Frances Perkins' National Conference on Silicosis (1936-37); the

organization of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (1939); the establishment of the Industrial Hygiene Foundation (1936); the creation of the first Industrial Hygiene Division in a State Health Department (Connecticut, 1928); the establishment of the WILLIAM S. KNUDSEN AWARD for outstanding achievement in industrial medicine (1938); the organization of the American Association of Industrial Nurses (1942).

These were "events." Many more will come to mind. It is not likely that any two persons would agree on all of the 10 most important; less likely that they would put them in the same order.

ANOTHER basis of rating, which brings in a different list could be that of stimulation or motivation. Some events touched off long trains of developments in industrial medical matters. Notable were the Gauley Bridge disaster (1934), and the radium poisoning episode (1925). Both had a nation-wide impact. Another stimulus of profound effect was the original Social Security Act which provided Federal funds for industrial hygiene (1936).

AND STILL one more basis might pass the events, per se, and list the developments. Such a list could include the recognition of industrial medicine as a subject to be taught in medical schools; the generally accepted, though still unofficial, recognition of industrial medicine as a specialty; the extension of industrial medical service to include the services of x-ray and laboratory technicians, industrial hygienists, industrial nurses, industrial dentists, aptitude testing technicians, industrial psychiatrists, and consultants; the identification of industrial health and its facilities with community health and its needs; the interest and activities of lay and management organizations in the problems of industrial health—exemplified by the programs and publications of the National Association of Manufacturers, the United States Chamber of Commerce, the Industrial Hygiene Foundation, the National Industrial Conference Board, and others; the participation of labor unions in matters of employee health, and their establishment of organized medical services, such as that of the International Ladies' Garment Workers Union; the recognition by management that employee health and medical services are profitable management functions; and the demonstrated importance of industrial medicine as part of our national defense and war potential. As to the latter, an "event" which had a great deal to do with getting the war effort in industrial medicine off on the right foot was the organization by DR. FRANKLIN H. MARTIN, Director General of the American College of Surgeons, of the Committee of Industrial Medicine and Surgery of the General Medical Board of the Council of National Defense in 1917.

Equally important, perhaps, as a long range development, has been the metamorphosis of the physical examination. This, in the early days of workmen's compensation, began as a selective process, later serving as a means of pre-placement discrimination, but gradually growing into its present universal acceptance as an agency of job placement—not only for the healthy with special or limited aptitudes, but equally for the handicapped and rehabilitated for the best use of their remainders of ability.

And last, but not least, among the outstanding developments in our field of industrial medicine, has been the acknowledgment by the medical profession of the fact that the industrial physician must be almost as familiar with the working conditions of his employee patients as he is with the physical details of his own office—in other words, that he must accept responsibility for the safety and salubrity of the working environment. This, indeed, has a high place in the order of importance.

OVER the whole picture, like a "sun-lit arch," is the present-day standing of industrial medicine and industrial hygiene—not only in technical and professional eminence, but also in the pattern of our national economy. No better evidence of this can be found than the fact that the five professional organizations in the field are high-lighting the year 1950 with an eight-day Industrial Health Conference in Chicago in April, at which more than *100 papers* of medical and scientific importance will be read, to an audience of international representation. The sequence of meetings, of which this is the thirty-fifth, began in 1916, when the small group then identifiable as industrial physicians gathered in Detroit to spend an afternoon listening to *four papers*. In this, as well as in other respects, contrast may be a gauge of development.

All of the foregoing is by way of opinion. We would be grateful for expressions which differ from ours. The subject has continuing interest.

A last question asked of us is: "What are the trends in your field? and why?" Is there a better answer than: "More—much more—of the same, and for the same reasons?"

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1. Arminio, J. J., and Sweet, C. C.: Indust. Med. 18: 12 (Dec.) 1949. 2. Tebrock, H. E.: Indust. Med. 19: 1 (Jan.) 1950.

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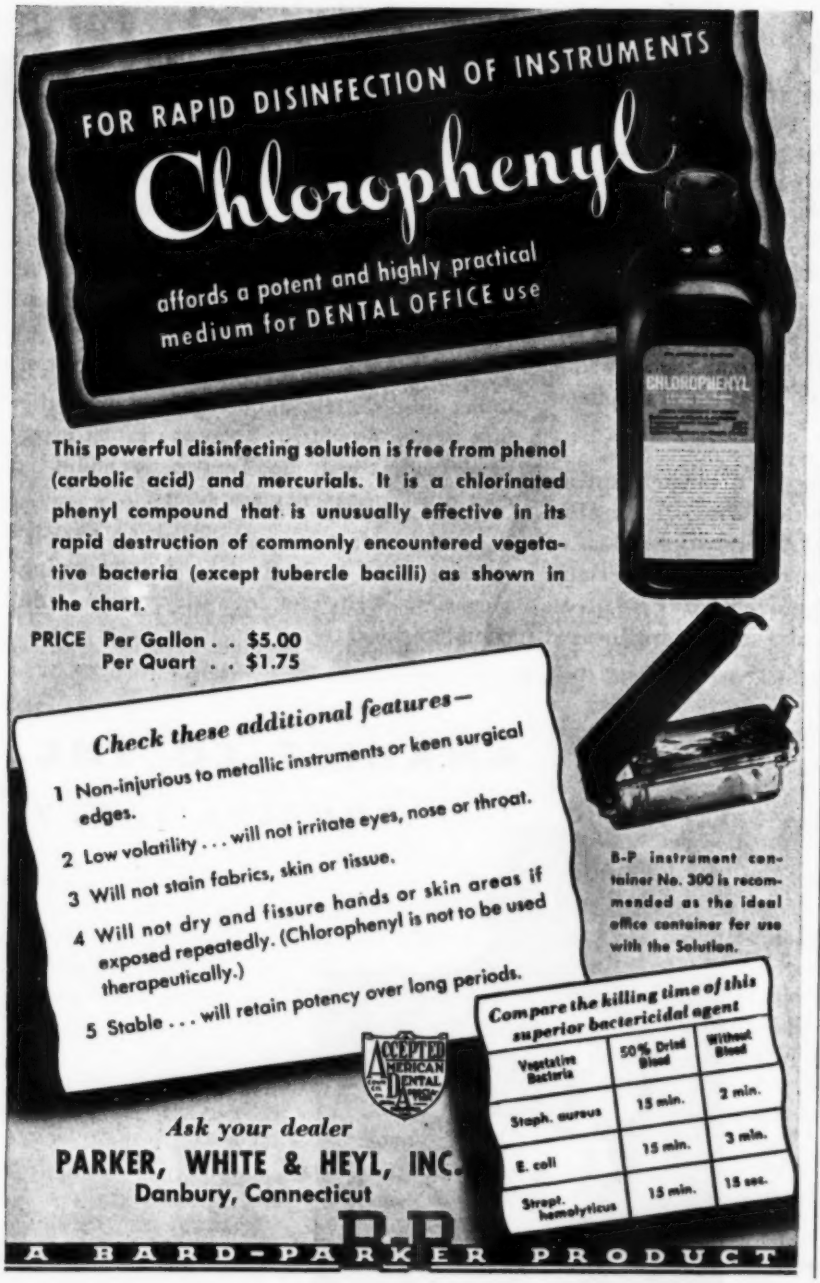
INDUSTRY can give the government cards and spades in the matter of efficient personnel administration. A tidbit from the Hoover Commission Report shows that to recruit, test, and place one person on the Federal payroll costs $70 per employee. In industry the recruiting, testing, and placement costs average less than $25 per worker.

—LAWRENCE STESSIN in *Mill & Factory*, September, 1949, quoted in *The Management Review*, December, 1949.

No Increase

IT HAS been thought by many that companies selling workmen's compensation insurance coverage increase the premium where the physically handicapped are employed. This is not true. Rates are based on experience of the class of industry and modified in most cases by the individual plant experience. There is no indication that losses are increased when the physically handicapped are properly placed. We do not believe that the rejection of the physically handicapped from employment for that reason is either necessary or sound procedure.

—ROBERT B. O'CONNOR, M.D., Liberty Mutual Insurance Company, in *Industrial Hygiene Newsletter*, January, 1949.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Great Lakes Test

THE navy medical research unit at Great Lakes, Illinois, naval training center, has started an experiment with two 500-man groups to weigh the merits of antihistamines in treating and preventing colds, the navy said today. The research project, begun November 15, will continue five months. Results will be evaluated by the navy bureau of medicine and surgery. One of the 500-man groups will be administered the antihistamine drugs to determine their action in preventing colds and the other group in treating colds. Rear Admiral Clifford A. Swanson, navy surgeon general, said the study is the first official research undertaken by the navy on these drugs. Unofficial studies were made previously by Captain J. M. Brewster, navy physician, at Great Lakes and at the naval air station at Corpus Christi, Texas.

—*Chicago Tribune*, December 23, 1949.

The Pocketbook Nerve

MY TRUCKDRIVER husband paid $86 to his union last year, just for belonging. He says some unions already are asking for more for their political campaign. How come the doctors can run their campaigns for an assessment of $25?" That question, posted in one of the many letters stimulated by the National Education Campaign of the A.M.A., sent a researcher to the telephone at the request of the Board of Trustees. Here are fees reported paid just for membership, not for special activities, by members of

typical organizations: Teamsters union local: initiation fee $100.00, annual dues, $75.00; Architects, $45.00; American National Retail Jewelers, $150.00; Chicago Newspaper Guild (on earnings of $100.00 per week), $60.00; Insurance (typical groups), $50.00; Purchasing Agents, $35.00; Motion Picture Operators, $42.00.

Sound Investment

THE management of our group of companies is completely "sold" on industrial medicine as a sound economic investment. We know that it is impossible to assess all the benefits derived from its application, but it is manifest to us that healthy minds and bodies produce clear thinking, alert physical activity and mental happiness. These three, when brought into play by the individual, produce better workmanship, better quality of product and, on the whole, a healthier social fabric. This, in the opinion of our company, is the goal we should all set our hands to.

—From "An Executive's View of Industrial Medicine," by J. A. CHAMBERS, Vice-President and General Manager, George Weston, Ltd., Toronto, in *Canadian M.A.J.*

Most Selfish

WHO DO YOU THINK are the most selfish interests today—the business men, the labor unions, the farmers, the government officials or any other group?" In reply to this query made recently in a Psychological Corporation survey of people in 138 cities from coast to coast, labor unions were named as the most selfish interest by 42% of all respondents, government officials by 19%, business men by 17%, and farmers by 4%. The remainder said "all of them" or named other groups.

—*The Management Review*, December, 1949.

Savings

AS AN illustration of the premium savings possible, a comparison recently appeared of the compensation premiums paid by two companies of identical types of operation which were, in fact, competitors. Both developed an annual payroll of $600,000, and both were subject to exactly the same basic premium rate. One company succeeded in reducing plant accidents to the point where it now pays a premium of $1 per $100 of payroll, while the other, which developed an unfavorable accident record, is charged a debit on the manual rate and pays $3.31 for exactly the same insurance coverage. This difference of $2.31 for each $100 of payroll amounts to $13,860 annually. Insurance companies can produce instances where employers have halved their compensation premiums in two years or less by means of well-organized accident prevention programs, and in large establishments this might bring about some very substantial savings.

—J. DEWEY DORSETT, in *Credit & Financial Management*, quoted in *The Management Review*, December, 1949.

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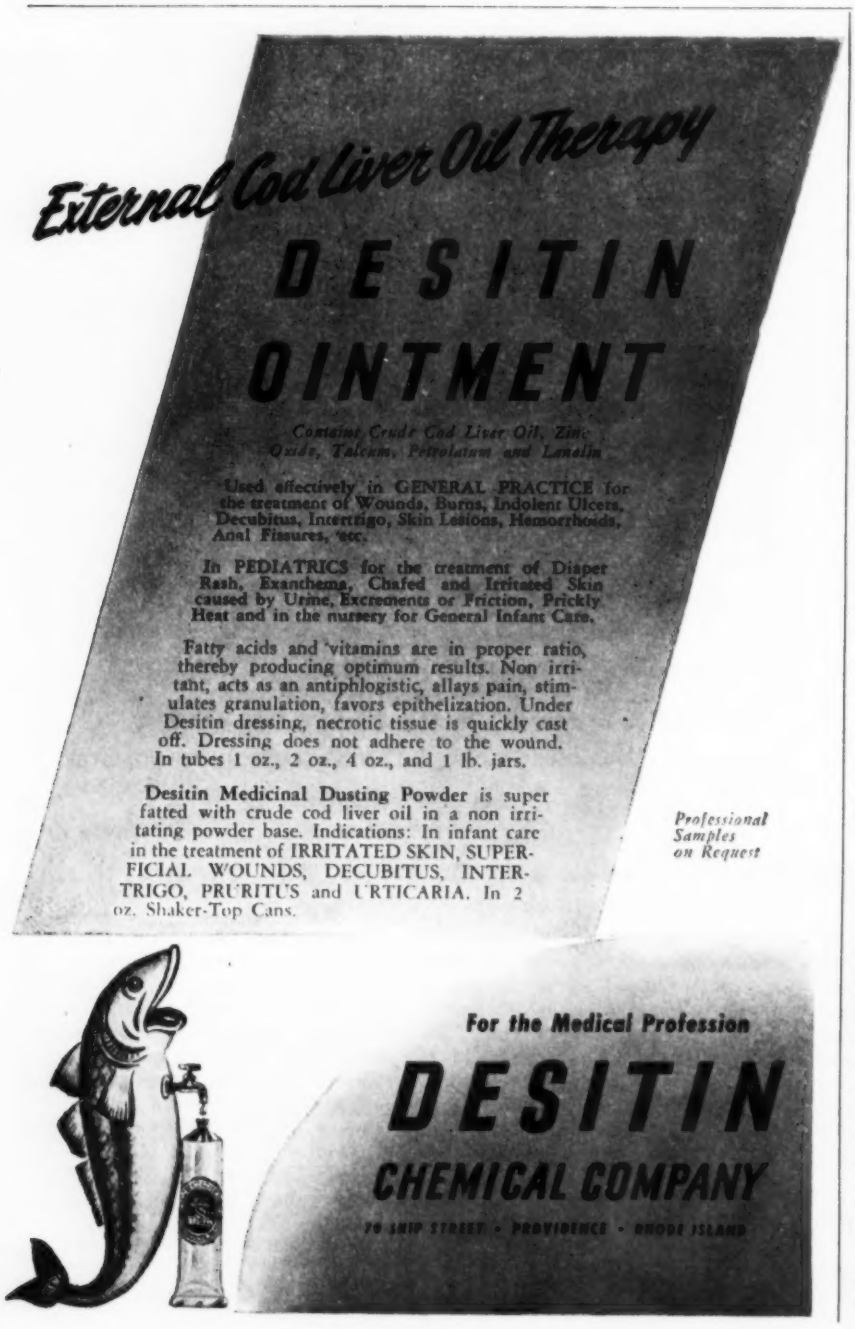
After Retirement

I RAISE the strongest objection, however, to the implication that industrial management should be held responsible for developing hobbies, recreation, and "a happy life" for retired employees to determine whether they make "constructive use" of their own time, and, if not, do it for them. I also object to the implication that by paying an individual fairly for services rendered, an industrial concern acquires any greater responsibility to shield a citizen from the rigors of personal life than an individual personally assumes to the corner grocer who has served him for years, the physician who has treated him, or the handy man he has employed. I object to the implication that industrial employees in some sense have surrendered or lost their freedom and responsibility to stand on their own feet, determine their own destiny and finance it by their own efforts.

—*The Conference Board Management Record* (National Industrial Conference Board, Inc., 247 Park Ave., New York), March, 1949, p. 121:3, quoted in *The Management Review*, December, 1949.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Automotive Research

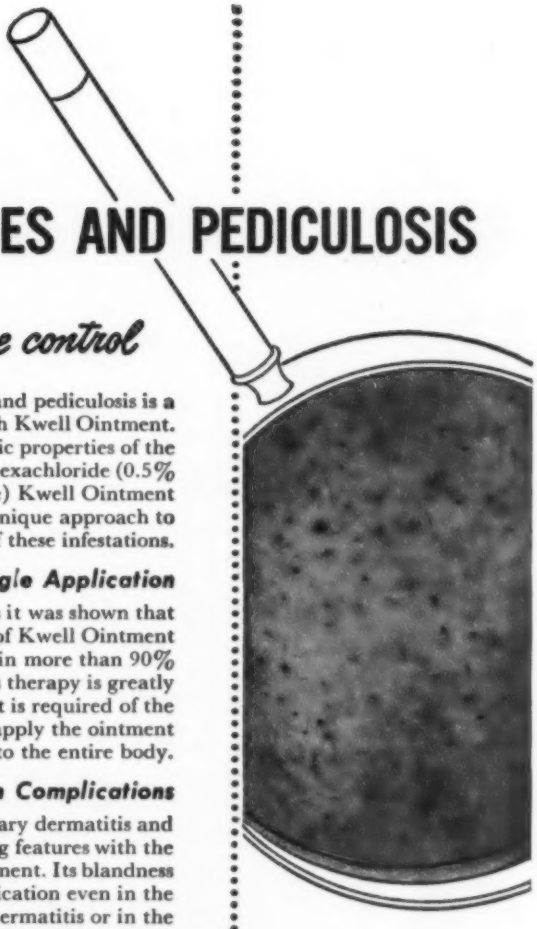
IMPORTANT advances in medical science over the years have been a by-product of automotive research. Recently, for example, an electronic device developed by an automotive firm for use in heat-treating of steel was adapted to saving the lives of patients in many types of surgery. The device, attached to the ear lobe of a patient on the operating table, instantly detects any slight change in oxygen content of the bloodstream, by measuring infinitesimal changes in the blood's color. Formerly, the anesthetist and surgeon had to watch the patient's color, pulse and other symptoms to decide whether more or less oxygen was needed. But too often the symptoms of death were too slow in coming, and adjustment in oxygen supply was made too late. The automotive firm's researchers worked with a group of surgeons to perfect the device. It's being put to scores of further use — determining whether a patient has heart or lung ailments, guiding surgery to rearrange arteries of "blue babies," and in military tests of the atomic bomb. Detroit's best-known industrial hospital, established by one car maker, has worked with research departments of several automotive firms to develop scores of devices and practices now widely used. From this hospital's research work came the modern use of iodine in salt to prevent goiter; life-saving methods of handling severe burns; modern fever therapy and hernia treatments, and many other standard medical practices. The modern hospital bed, with cranks to raise or lower sections of the bed, was developed in an automotive plant. One such device, developed recently by an automotive plant official in his home workship, is an electric skin cutter for use in skin-grafting operations. Used today in hospitals all over U. S., it ended the need for great skill in slicing off a split thickness of skin for use in grafting— and lets a

surgeon cut in a few minutes as much skin as he previously could cut in an hour.

—*Automobile Facts*, in *Industrial Hygiene Digest*, December, 1949.

Physician's Part

FOLLOWING is the author's summary of "Disability Evaluation in Industrial Pulmonary Disease," by GEORGE W. WRIGHT, M.D., in *Journal of the American Medical Association*, December 24, 1949: "Physicians are directly responsible for a part of the confusion and difficulty which attends the administration of workmen's compensation for pulmonary disease of industrial origin. Careful consideration of the following questions may assist the medical expert in clarifying the situation: (1) is there a clear understanding of the legal definition of disability? (2) Is there a full appreciation of the actual limits of the physician's ability to recognize and quantitate the existing degree of cardiorespiratory dysfunction? (3) Is there a thorough knowledge of the characteristics of the specific job at which the allegedly disabled man is employed; and is there a full understanding of the physical requirements needed to carry on this type of employment? (4) Is there a conscientious discrimination between occupational as opposed to non-occupational or natural causes for the disability? (5) Is there constant vigilance in avoiding the expression of that which is speculation as though it were in reality a fact? Where substantiating evidence is not available, are expressions of thought scrupulously labeled as opinion? (6) Is there willingness to frankly admit ignorance of specific information? Thoughtful consideration of these questions should lead to an appreciation of the great responsibilities of the medical expert. The scarcity of factual information and lack of knowledge of already established fact are responsible for the major part of the medical expert's shortcomings. Additional study is certainly needed. In the planning of further investigations, a proper sample of all persons who have the disease or who have been exposed to the hazard must be studied, if one is to obtain a true picture of the industrial disease under scrutiny."



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Health Hints

GOOD lighting in industrial plants and offices, as well as in schools and homes, is a necessity where maintenance of health and operating efficiency is concerned....If fever, body-aches or weakness accompany a cold, or if coughing of mucous from the chest occurs, consult a physician immediately. The cold is past the "common" stage if any of the mentioned symptoms show . . . A good lunch, well planned and well packed, pays dividends in health and morale. The lunch should be planned to fit in with and supplement the other meals of the day . . . Beware of carbon monoxide—it is a killer which has caused thousands and thousands of accidental deaths. Don't run your automobile engine in an enclosed space, such as a garage, with the doors closed . . . Care of the feet should take close to top billing when the health

of the various parts of the body is considered . . . The human body can take an astonishing amount of punishment and still function; however, it does need care, rest and proper nourishment . . . Worry causes sickness—sickness causes worry. If one can be banished both most likely will disappear.

—JOHN C. SCOTT, in *Industrial Health*, December, 1949, published by the Health League of Canada, Toronto.

The Road Ahead

FOR those concerned with reversing the direction in which he believes America is going—and this should include every doctor and all other citizens as well—MR. FLYNN (JOHN T. FLYNN, author of "The Roosevelt Myth" and "The Road Ahead") suggests 10 bases for action: (1) We must put human freedom as the first of our demands. (2) We must stop apologizing for our capitalistic society. (3) We must not take one more step into socialism. (4) We must get rid of compromising leaders. (5) We must recognize that we are in the midst of a revolution and begin to fight it as such. (6) We must put an end to the orgy of spending. (7) We must put an end to crisis government. (8) We must stop "planning" for socialism and begin planning to make our free system of private enterprise operate at its highest capacity. (9) We must set about rebuilding in its integrity our republican system of government. (10) We cannot depend on any political party to save us. We must build a power outside the parties so strong that the parties will be compelled to yield to its demand.

—Editorial Comment by WILLIAM M. GAMBRELL, M.D., President-Elect, State Medical Association of Texas, in *Texas State J. Med.*, December, 1949.

Protein for Breakfast

IN A RECENT United States Department of Agriculture report on a scientific breakfast study, it is stated that something new can be added to the popular slogan, "Eat a good breakfast to start a good day." The addition is "...and put in some protein-rich foods." It is an advantage, the government nutritionists conclude, to provide about a third of the day's protein allowance in breakfast, and to have some top-quality protein in this meal for a sense of well-being. The National Research Council's yardstick for good nutrition provides for protein on the scale of 60 grams daily for an average-sized woman, 70 grams for a man. To give some idea of how breakfasts can include a third of the day's protein, or about 20 to 24 grams, a list of foods commonly eaten at breakfast was evaluated as to protein content. A widely recommended and widely endorsed breakfast which supplies the needed proportion of protein is a basic breakfast consisting of fruit, cereal, milk, bread and butter. This cereal breakfast provides protein of top quality, adequate to satisfy all body requirements. It also supplies other nutritional essentials which the body needs to operate at maximum efficiency during the morning hours. Outstanding economy is another reason this basic breakfast pattern is endorsed by medical and nutrition authorities. It costs only about 15 cents per person when served at home. The cereal and milk serving, which is an economical main dish in this basic breakfast, itself makes a significant contribution of top-quality protein, important B vitamins, essential minerals, and food energy. The cost of the average serving of one ounce of cereal and four ounces of milk is

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barely four cents. Few other foods contribute as much to the satisfaction of daily nutritional requirements for this small cost.

In New York

NEW YORK'S disability insurance law covering some six million workers is now in effect. For the first six months, while preliminary matching employee and employer payroll contributions build up a special benefit fund, no benefits will be paid. But after July 1, workers, who will then be contributing up to ½ of 1% of their weekly pay, or a maximum of 30 cents a week, may collect from $10 to $26 a week while incapacitated by sickness or accident not covered by workmen's compensation. Benefits may extend for 13 weeks in any one year, and begin a week after the illness or accident keeps a man from work.

—*New York Herald Tribune*, January 3, 1950.

Pollution

INDUSTRY'S bill for eliminating air and water pollution is now running as high as $300 million annually, with prospects that many more millions will be required before a "modest level of purity" is achieved in the nation's air and water.

—*Forbes*, December 15, 1949.

Goal

DR. L. M. PETRIE (Industrial Hygiene Division, Georgia Department of Public Health) envisions a cooperative industrial health center with physicians, nurses and laboratory to serve a number of plants, the cost of which will be pro-rated among the plants concerned. Each plant would have its own first aid room. He estimates that 1,000 employees can be given adequate preventive medical and health protection in industrial areas at a cost of $14,000 per year, or $14.40 per capita. A health center serving 2,000 employees a year could be operated for $12.50 per capita, and one serving 5,000 employees would cost $8.75 per capita, while a health center building for 2,000 workers would cost approximately $20,000. These centers would provide periodic screening industrial health examinations for all workers and on-the-job treatment for emergencies; would serve as a training center for professional schools, and would be able to provide industry with industrial hygiene and sanitation surveys. The centers would be directed by a board of directors composed of representatives of industrial management, labor, professional schools, health departments and medical societies. Cooperative health centers in Griffin and Winder are already serving industry in those areas with health services similar to those outlined.

—*Atlanta Constitution*, December 4, 1949.

Security

MAYBE "security" has been overplayed. The young man looking for security can find more of it in the Army than anywhere. Yet the Army still has to advertise for recruits.

for the successful treatment of...

the DAXALAN-DOME-PASTE BANDAGE TECHNIQUE . . .

as introduced by Dr. William M. Cooper

Director, Department of Peripheral Vascular Diseases—New York Polyclinic Medical School and Hospital

This technique is based on a 3 point program

1. Reduce the dermatitis with wet dressings of DOMEBORO TABS (Burow's Solution)
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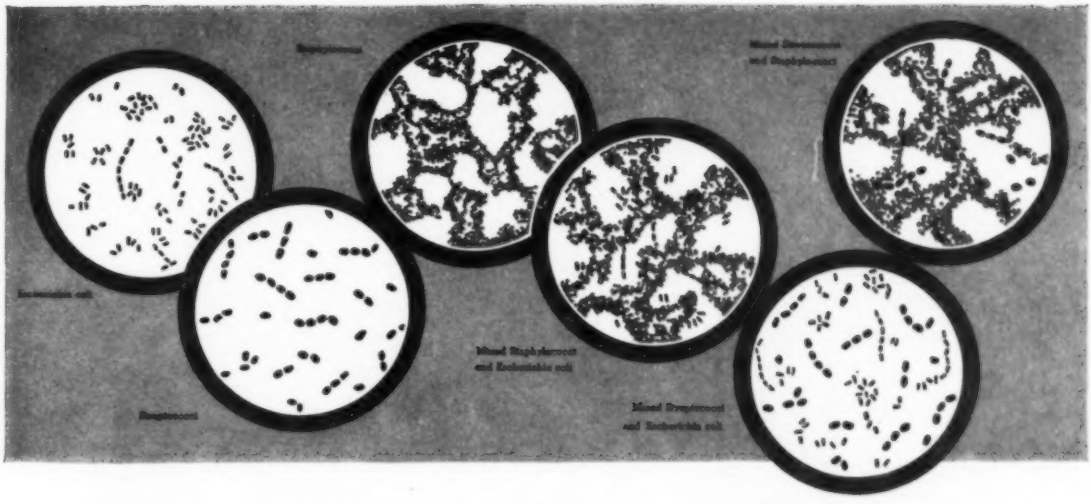

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1. Butt, A. J.: J. Florida M. A. 35: 430 (1949). 2. Carroll, G., and Allen, H. N.: J. Urol. 55: 674 (1946). 3. Kirwin, T. J., and Bridges, J. P.: Am. J. Surg. 52: 477 (1941). 4. Scudi, I. V., and Duca, C. J.: J. Urol. 61: 459 (1949).

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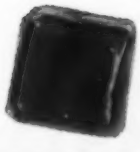

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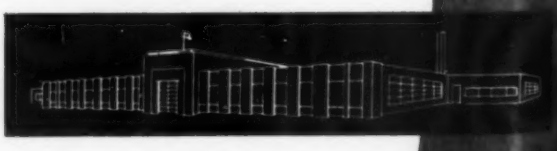

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8

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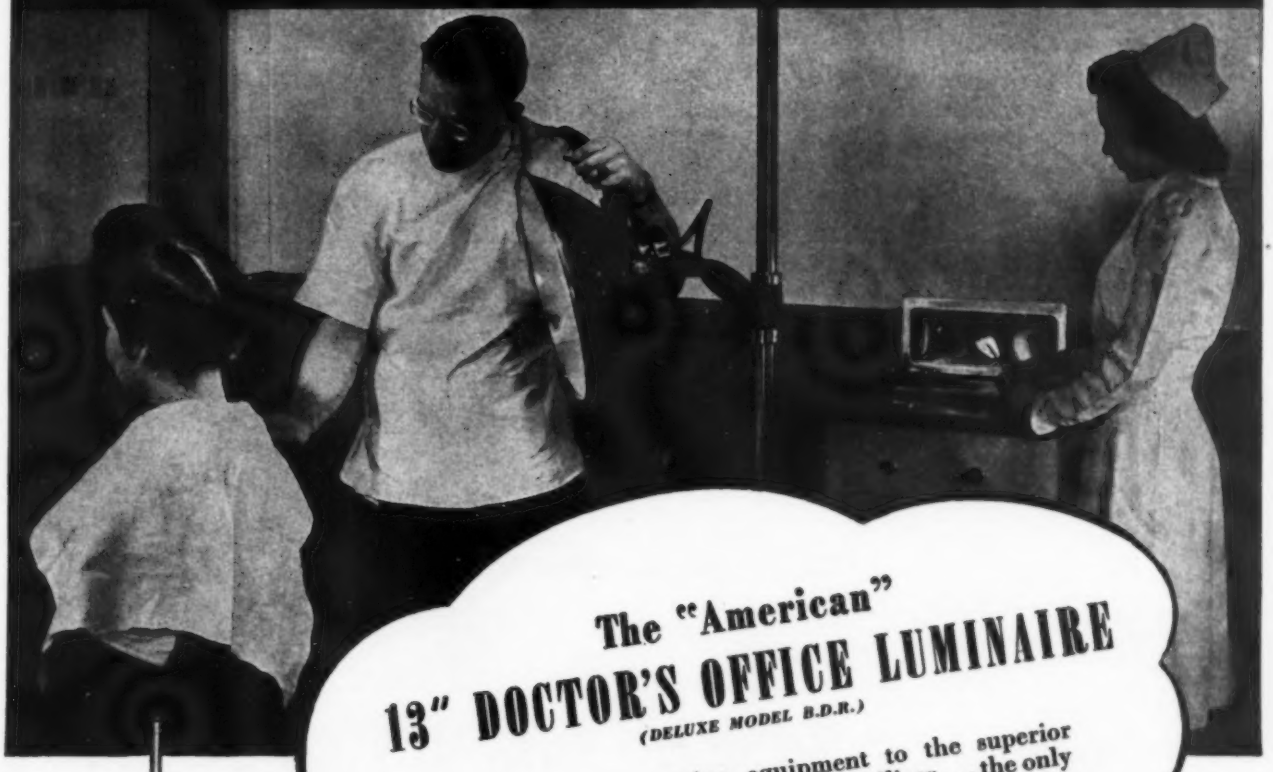

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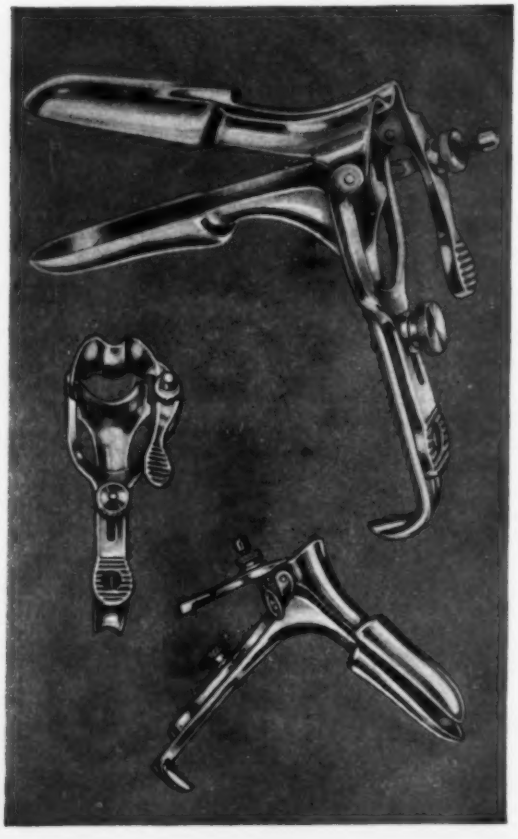

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from distressing symptoms

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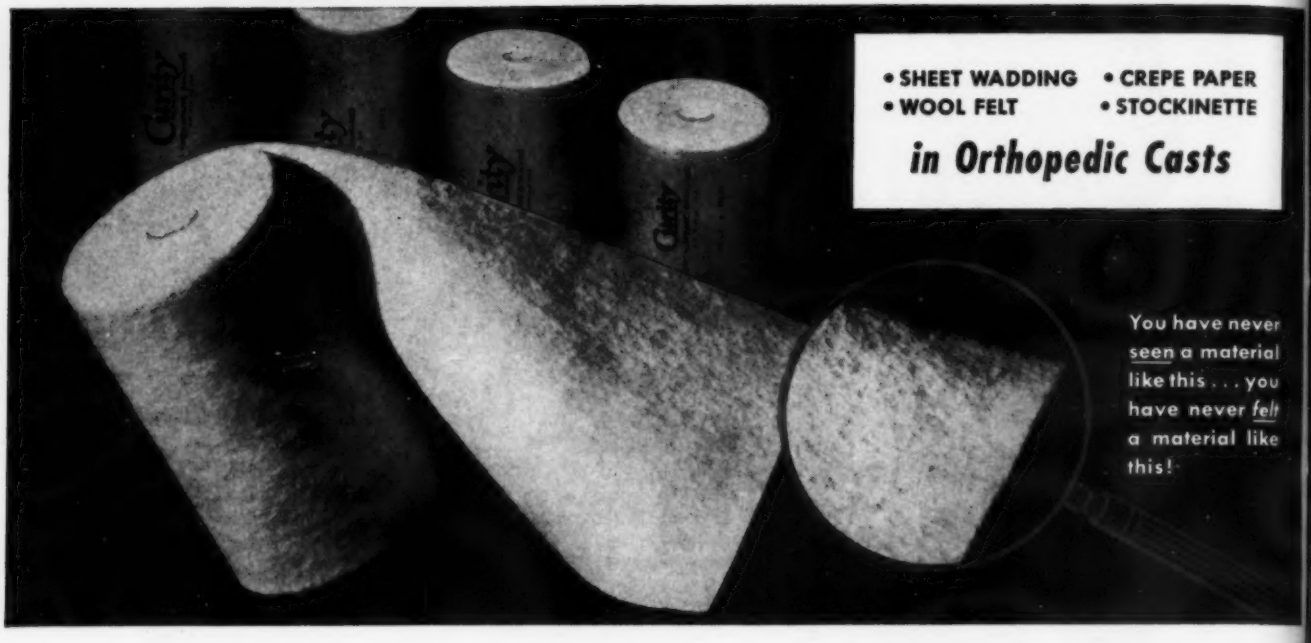
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Palais des Tuileries,
Paris

"This majestic bronze — a masterpiece — is Barye's most famous creation."[1] One of history's more prominent artists — "certainly one of its greatest sculptors — he has in his way no rivals."[2] Barye's superiority, like that of any great craftsman, is achievement due neither to good luck nor mischance but is the result of constant, patient and tireless effort to attain the greatest degree of excellence.

Outstanding merit in any field is rewarded by acceptance and appreciation that creates unrivalled leadership. Fortunately, among occupational skin cleansers, Pax Heavy Duty has enjoyed and held the preference of America's greatest companies for nearly a quarter century because of its inflexible adherence to the highest standards of quality and performance. For cleansing efficiency, safety, economy and every other desirable factor Pax Heavy Duty remains unsurpassed.

[1]Among Sculptures, by Charles Louis Borgmeyer
[2]French Art, by W. C. Brownell

PAX-LANO-SAV HEAVY DUTY
GRANULATED SKIN CLEANSER

PAX®

PAX-LANO-SAV* -a superior skin emollient combining lanolin and other special skin normalizers.

The Pax trademark symbolizes a deep-rooted tradition of superlative quality maintained through almost a quarter century of continuous research and development.

ADVERTISED IN AMERICAN MEDICAL ASSOCIATION PUBLICATIONS

G. H. PACKWOOD MANUFACTURING CO. • 1545-55 TOWER GROVE AVE. • ST. LOUIS 10, MO.

Manufacturers of Fine Industrial Skin Cleansers

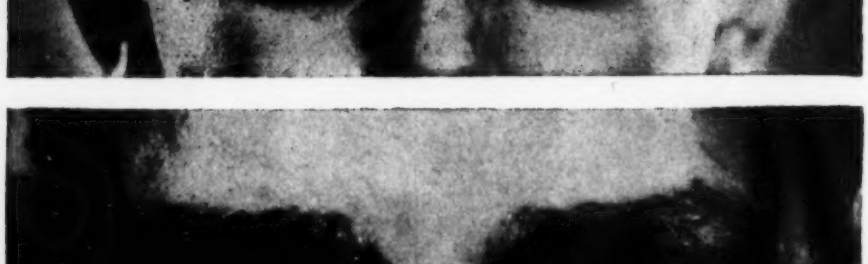
*Tradename of G. H. Packwood Mfg. Co.

In addition to PAX-LANO-SAV HEAVY DUTY, PAX also offers the following powdered or granulated quality skin cleansers: PAX CORN-TEX • PAX HYSPEED • DICTATOR SPECIAL PURPOSE • BORAPAX • SUPER-X • VELVAPAX LIGHT DUTY • OFFICE-PAX • PAX MECHANICS. Also available are PAX WATERLESS and PAX HECTO INK CLEANSING CREAM • PAX SKIN CLEANSER ECONOMIZER DISPENSERS • and many other fine PAX Products. 50-A

How will they look to YOU a few years from now?

Your wife's eyes: What will you read in hers when she asks whether you can afford that modest cottage that's for sale?

Your boy's eyes: What will you see in his eyes the day he asks whether you can afford to send him to college?



Your own eyes: What will the mirror tell you about them when it's time to retire, and take things easier?

There's no better time than right now to sit back and think what *you* will see in your family's eyes a few years from now.

Whether they glow with happiness or turn aside with disappointment depends, to a very large extent, upon what you do *now*.

So plan *now* for that home you plan to buy eventually . . . set aside money *now* for his college education . . . plan *now* for the day you can retire.

Decide now to put part of your salary week after week, year after year in U. S. Savings Bonds, so that you will have the money for the *important* things you and your family want.

Insure your future by signing up on the Payroll Savings Plan where you work, or the Bond-A-Month Plan where you have a checking account. Chances are you won't miss the money now, but you certainly will a few short years from now if you haven't got it!!

P. S. Remember, too, that every $3 you invest now in U. S. Savings Bonds returns $4 to you in just ten short years.

Automatic saving is sure saving — U.S. SAVINGS BONDS

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Persistent PSORIASIS *yields to* RIASOL

Clinical reports are available which prove that RIASOL may clear all the skin lesions of psoriasis in a few weeks, even in cases which have lasted for many years. With continued treatment for several months, recurrences are often avoided.

All claims for RIASOL are based on thorough clinical research. This is your assurance that the patient is getting an adequately tested product when you prescribe RIASOL. Clinical investigation of RIASOL has covered a period of many years and is still in progress.

RIASOL contains 0.45% mercury chemically combined with soaps, 0.5% phenol and 0.75% cresol in a washable, non-staining, odorless vehicle.

Apply daily after a mild soap bath and thorough drying. A thin, invisible, economical film suffices. No bandages necessary. After one week, adjust to patient's progress.

RIASOL is ethically promoted. Supplied in 4 and 8 fld. oz. bottles at pharmacies or direct.

Mail coupon today for your free clinical package. Prove RIASOL in your own practice.

Before Use of Riasol

After Use of Riasol

SPECIAL NOTICE

New product. Name RISM. Used in Arthritis and Rheumatism. Rism is a new and more effective prescription for relief of the pains and aches, swelling and stiffness caused by arthritis and rheumatism. Send for a clinical supply.

MAIL COUPON TODAY —
PROVE RIASOL YOURSELF

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12850 Mansfield Avenue, Detroit 27, Michigan

Please send me professional literature and generous clinical package of RIASOL.

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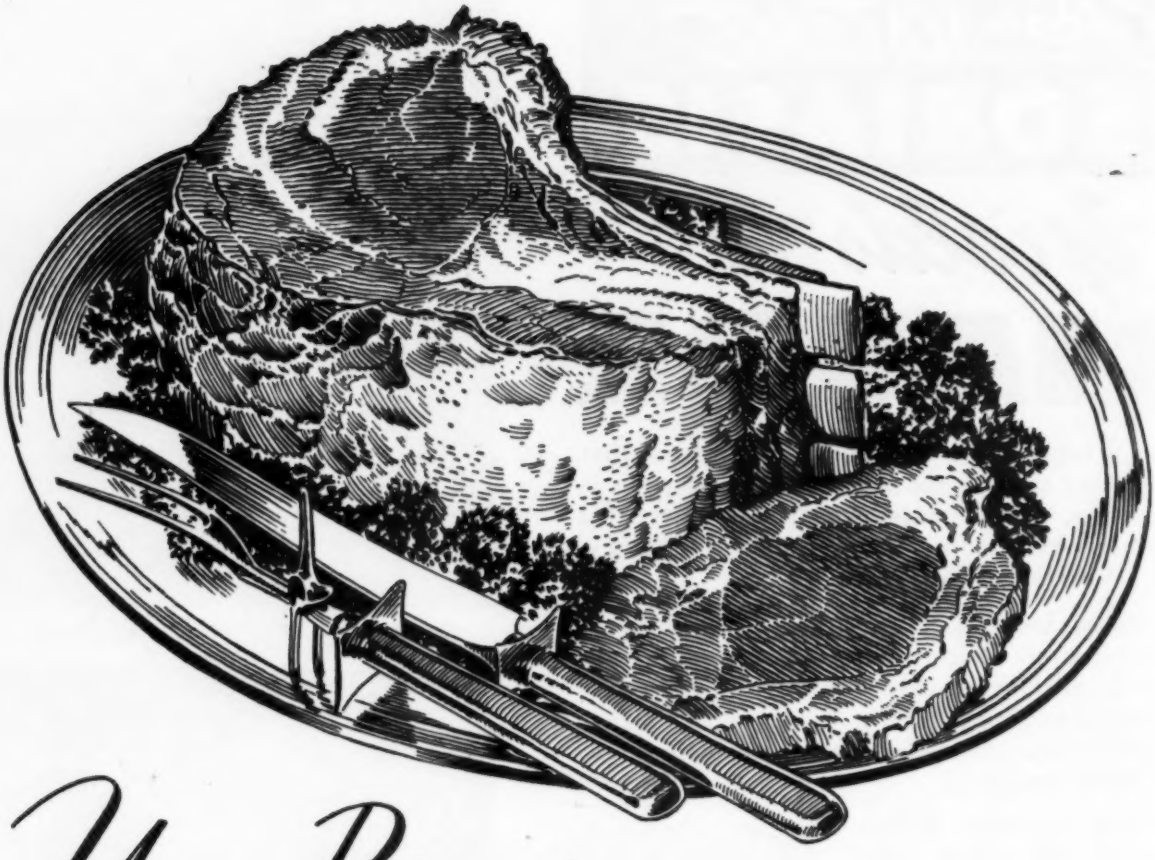
City _____ Zone _____ State _____

Druggist _____ Address _____

RIASOL for PSORIASIS



Your Patients...

And the Meat They Eat

The established relationship between sound dietary planning and a state of maintained good health emphasizes the nutritional importance of meat, man's favorite protein food.

Not only does meat taste good, but of greater significance, it provides a host of nutritional benefits. Developments in the field of nutrition* have proved that complete protein—the kind that meat supplies in abundance—aids in building and maintaining immunity, hastens recovery after acute infectious diseases and following injury and burns, promotes health during pregnancy, aids in the growth and development of husky children, and is needed to maintain everyone in top physical condition.

No matter from what walk of life your patients come, and whether their pocketbooks demand economy or permit satisfaction of that urge for the fanciest cuts, meat gives them full value for their money.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

*McLester, J. S.: Protein Comes Into Its Own, J.A.M.A. *139*:897 (Apr. 2) 1949.

American Meat Institute

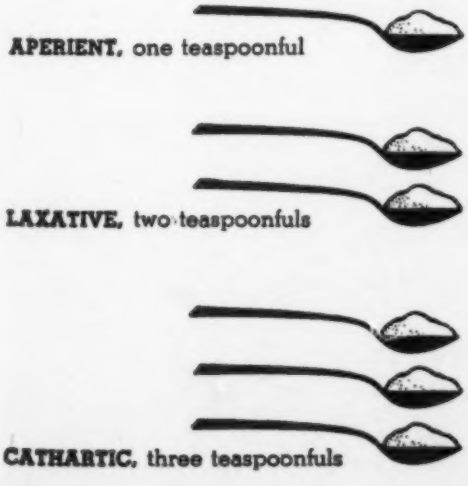
Main Office, Chicago...Members Throughout the United States

Convenient

for you...

for your patient

the saline laxative--



APERIENT, one teaspoonful

LAXATIVE, two teaspoonfuls

CATHARTIC, three teaspoonfuls

Whether your patient needs a laxative, or an aperient, or a cathartic you'll find it more convenient to write Sal Hepatica on your prescription pad. No need to specify all the ingredients of three separate formulas, just prescribe Sal Hepatica and indicate the dosage.

Your patients will find Sal Hepatica convenient, too. No cluttering of shelves with bottles of different laxatives when one will serve. They'll like its pleasant taste, its effervescence—and, of course, its prompt, gentle action.

a product of **BRISTOL-MYERS**

19 West 50 Street, New York 20, N. Y.

New concept of control in nasal congestion

Antistine-Privine
NASAL SOLUTION

A combination of an Antihistaminic and Vasoconstrictor

Antistine-Privine gives prompt, prolonged relief from allergic nasal manifestations accompanying the common cold and in hay fever.

This new synergistic combination contains the effective antihistaminic, Antistine, to block the congestive action of histamine and the most potent vasoconstrictor, Privine, to shrink the nasal mucosa.

It has been established that "the decongestant action of Antistine-Privine on the allergic nasal mucosa in many instances appears to be more intense and prolonged than from either solution alone."[1]

Privine is still available, of course, for use in those conditions where the antihistamine component is considered unnecessary.

ANTISTINE-PRIVINE, aqueous solution of Antistine 0.5%, and Privine 0.25%, in bottles of 1 fl. oz. with dropper. **DOSAGE:** 2 to 3 drops in each nostril 3 or 4 times daily.

PRIVINE hydrochloride, 0.05% solution in 1 oz. dropper bottles for prescription; 0.1% solution reserved for office procedures, in 1 pint bottles only.

1. Friedlaender & Friedlaender: Amer. Pract. 2:643, June, 1948

Ciba PHARMACEUTICAL PRODUCTS, INC., SUMMIT, NEW JERSEY

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